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Metals Review

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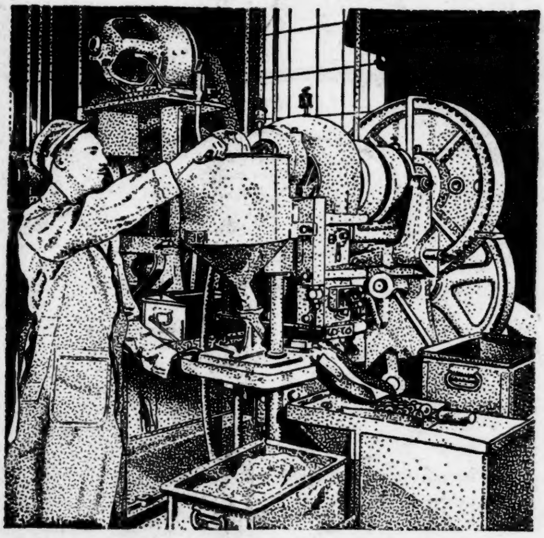
NONFERROUS METALS ISSUE



Featuring

Production & Properties of Nonferrous Metals

By John L. Everhart
Metallurgist, Nonferrous Division
Battelle Memorial Institute

Technology of Aluminum and Magnesium

By L. W. Eastwood
Assistant Supervisor, Process Metallurgy
Battelle Memorial Institute

Two articles giving a critical appraisal of developments in the production and properties of nonferrous metals during recent months as described in the literature.

Products and Processes for the Nonferrous Industry

New melting furnaces, foundry supplies, die-casting machines, and other production equipment; new alloy compositions and powder metallurgy progress, as described by the manufacturers during the past year.

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NEXT MONTH — MACHINING AND MACHINE TOOLS

Metals Review

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February 1947

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AMERICAN SOCIETY FOR METALS

Nonferrous Metals

Their Production and Properties (Other Than the Light Metals)

By John L. Everhart

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MANY OF THE metallurgical advances reported during the past year were concerned with developments which were on the classified list during the war and are gradually being released for publication. As a consequence, the first published report of a process or product is frequently descriptive of an accomplished commercial operation rather than the more usual discussion of a laboratory or pilot-plant test. In the general nonferrous field, several interesting processes for the production or refining of various metals were described, at least one of which shows promise of application in fields other than that for which it was developed.

A number of alloys, particularly for high-temperature service, have been declassified, and their properties indicate definite possibilities of usefulness in ordinary peacetime service. It is to be hoped that the "secret" designation will be lifted from other developments in the near future. The flood of articles which followed release of the Smyth report on atomic energy contributed little additional information on the metallurgical aspects of the development, and it is probable that these data will be retained in the classified files until world conditions become much more settled than they are at present.

Production

Recovery of copper from secondary brasses is not a particularly difficult problem, but recovery of metallic zinc from these materials has been the object of a number of research investigations in the past. The announcement (15-25, October 1946)* of a process which has accomplished this objective commercially is therefore of interest to copper refiners. Other metallurgists may question why this development is of more than limited interest — the answer lies in the apparatus developed. The distillation furnace offers a new metallurgical tool for high-temperature application under controlled reducing or neutral atmospheres, and thus becomes of interest in many possible applications. Among those suggested are refining of aluminum and magnesium, treatment of byproducts in the production of ferrosilicon and (powder metallurgists, note) the sintering of some of the carbides and other high melting point materials in larger batches than usual.

Briefly, the process consists of melting the scrap in a melt-down furnace which serves as a reservoir to supply a continuous stream of metal to the distillation furnace, heated internally by electricity and operating at 3200° F. A large part of the zinc vaporizes immediately, and a constant flow of vapor is delivered to the condenser. After a predetermined quantity of melt has been supplied to the distillation furnace, the supply is cut off and distillation is continued until the temperature of the condenser shows a sharp drop. At this point the residual melt is tapped and the cycle repeated. The temperature of the condenser is a sensitive indicator of the progress of distillation.

Molten zinc is tapped from the discharge end at definite intervals. The zinc produced is suitable for brass making without further refining. Only ½% of blue powder (oxide) is formed during the distillation. Some of these units have been operating for two years with relatively low maintenance costs.

Continuing the work started several years ago on production of the less common metals, the Bureau of Mines has reported a number of developments in the electrowinning of manganese (1-27, May 1946), cobalt (2-18, February 1946), and chromium (2-74, July 1946), from domestic ores. The properties of some of these metals and their alloys indicate that in the near future they will become the specification materials for a number of severe service applications, and their production at a reasonable cost is a necessity. Basically, the process is the same for all three metals. It consists of leaching the ores, purifying the resulting solutions, and electrodepositing the metal.

The recently described manganese process has been operated in the pilot-plant stage for sufficient time to establish yields and obtain cost data. It is reported that 98.5 to 99.9% manganese may be produced with an over-all recovery of 88% at a cost of 7.5 cents per pound under conditions as favorable as those existing in Nevada.*

The cobalt process, originally developed for oxide ores, has been extended to include arseniferous cobalt ores. Satisfactory separation of the arsenic and cobalt may be accomplished by roasting and leaching. After this separation, the process is essentially the same as that reported previously. The principal difficulty lies in the build-up of nickel in the electrolyte. No satisfactory commercial method for its removal has been found.

The chromium process has been operated on a small pilot-plant scale with production of 50 lb. of chromium per day; it is reported that chromium may be deposited from trivalent solutions with a current efficiency of 45%.

Further developments in the production of ductile titanium by the reduction of the chloride with magnesium have also been announced by the Bureau of Mines (5-12, April 1946). Fifteen-pound batches of powder have been produced without encountering any technical difficulties which would interfere with large-scale production. The granular product has a purity exceeding 99%.

The limitations of the reverberatory furnace melting of cathode copper have been recognized for many years, and numerous attempts have been made to adopt electric furnace melting. Waddington and Bischoff (2-95, September 1946) describe the electric furnace process which is in operation at Copper Cliff, Ont., where a three-phase direct-arc furnace is used. Advantages claimed for the process are high uniformity of composition and physical properties; freedom from the contamination which occurs in reverberatory melting by combustion products and contact with iron blowing pipes and rabbling tools; simplification of the process which reduces the time necessary for the training of operators; and flexibility. Superintendents of refineries situated in areas where power costs make electric furnace melting economically impractical will view the Copper Cliff developments with envy.

A process for the production of beryllium copper from ore is described by Kjellgren (2-44, April 1946). Beryl ore is converted to the soluble form by melting and quenching. The beryllium is extracted with sulphuric acid, beryllium sulphate is crystallized from the solution, and the sulphate is converted to the oxide. Beryllium copper (4% Be) is produced by reducing the oxide with carbon in the presence of copper.

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*Literature references are designated by the corresponding item number in the Review of Current Metal Literature rather than by repeating the entire title, author and source; the reader can get this information by referring to *Metals Review* for the month indicated.

*Some controversy was raised by this article (1-27), as reflected in letters to the editor, published in the July 1946 issue of *Metals Review*, page 2, and the September issue, page 4.

Phillips (2-81, July 1946) describes a commercial method for the production of zinc ribbon directly from the melt which involves the pouring of molten zinc in a fine stream on a drum revolving with a peripheral speed of 630 ft. per min. Ductile ribbon less than an inch wide, several thousandths of an inch thick, and 50 ft. long, was produced from electrolytic zinc. Ribbon produced from lower grades of zinc had a tendency toward brittleness.

Superalloys for High-Temperature Service

With each year the line of demarcation between the ferrous and nonferrous alloys becomes more difficult to define. This is particularly true in the development of materials for high-temperature service in which the increasing complexity of the alloys makes it extremely difficult to determine which metal should be considered as the matrix. In a recent round-table discussion (23-201, August 1946), the entire field was surveyed, with particular reference to alloys developed during the war for the extreme conditions of temperature existing in gas turbines and jet engines. Perhaps the ferrous metallurgist considers this field his own, but many of the alloys contain iron merely as a minor constituent, and their development is an outstand-contribution to nonferrous metallurgy. It was brought out in this discussion that future developments will require that the matrix alloys be those of high melting points, and will probably be based on the group composed of chromium, cobalt, columbium, tungsten, molybdenum, tantalum, thorium, titanium, and platinum.

The properties desirable for extreme service must be considered as a group. To evaluate an alloy properly, stress at a given temperature must be correlated with expected life and with an allowable deformation. Short-time mechanical tests were found to be misleading, and the stress-rupture test was adopted for preliminary screening. The creep test was used for final evaluation, since stress-rupture tests may also be misleading.

The nonferrous alloys employed may be divided into two groups. For service between 1200 and 1350° F., a number of wrought, heat treatable alloys are suitable. Among these are several nickel-base alloys containing chromium, with aluminum and titanium added for precipitation hardening; several complex alloys based on nickel-chromium-cobalt; and a nickel-molybdenum alloy containing no chromium, which differs from all other alloys of this class. Alloys in the group may be forged and pressed into shape, and are precipitation hardenable. After such treatment, their properties are similar to those developed in the wrought iron-base alloys. They have been employed for turbine blades and other engine parts for service at 1200° F.

Another complex cobalt-nickel-chromium alloy, containing molybdenum and tungsten, which should be included in this group was discussed by Gordon (3-182, November 1946). This alloy may be readily forged or rolled and is precipitation hardenable. It is said to be unsurpassed in creep resistance by any other wrought alloy at temperatures above 1400° F., and to have good corrosion resistance at 1500° F. Its high-temperature properties approach those of the cast alloys which constitute the second group.

For service at 1500° F., cast heat treatable alloys have been found most suitable. Vitallium, an alloy based on cobalt-chromium-molybdenum, and several of its modifications have been found to be especially suitable. These alloys are generally precision cast to shape, and are characterized by their resistance to wear, heat, corrosion and erosion. They retain their strength by the gradual and constant precipitation of strengthening phases at the temperature of operation. During the war, most supercharger blades for operation at 1500° F. were precision cast from Vitallium, and it is considered probable that improvements in machine design will increase the permissible temperature of operation.

Other alloys in the development stage are a chromium-base alloy containing molybdenum and iron and a chromium-nickel-cobalt-tungsten alloy. In preliminary tests both of these alloys showed higher stress-rupture properties at 1600° F. than Vitallium.

Copper Alloys

The solution heat treatment of precipitation hardenable alloys is frequently a time-consuming operation because of the low rates of diffusion and solution of the hardening phases. Any method of speeding up this operation is, therefore, of considerable importance. Rosenthal, Lipson, and Marcus (3-175, November 1946) investigated the possibilities of quenching alloys from the solid solution range immediately after casting. Working with beryllium copper, they found that small precision castings quenched 5 min. after pouring, and castings treated in the conventional manner by solution heat treating for 3 hr. at 1450° F., had parallel properties after aging. Similar results were obtained with a copper alloy containing 9% aluminum. If further investigation shows that the method is applicable to other alloys and larger castings, this may be a very significant development.

Investigation of the effects of impurities or minor constituents on the properties of copper alloys has been in progress for a number of years. Two of the latest contributions are those of McLean and Northcott (3-192, November 1946) and Colton and Loring (3-115, August 1946). McLean and Northcott determined that antimony in 70-30 brass forms brittle films which are detrimental to working. They set a limit of 0.05% antimony for cold rolling; a slightly higher content is permissible for hot rolling. Antimony embrittlement may be reduced by adding phosphorus or lithium to the alloy; however, phosphorus injures the hot rolling properties and lithium adversely affects the general mechanical properties. Elimination of the antimony appears to be the best solution. Colton and Loring investigated the effects of phosphorus on cast gun metal. Small quantities of residual phosphorus (0.02% maximum) increase the density and improve the strength of the castings. Larger quantities are detrimental.

Investigation of the flux-degassing process, which has received considerable attention during the past few years, particularly in England, has been continued by Winterton (3-21, March 1946) and Pell-Walpole, Kondic and Forrester (3-118, August 1946). Winterton encountered no casting difficulties with the chill-cast phosphorus-tin bronzes, while the mechanical properties were greatly superior to those of conventionally cast alloys. Pell-Walpole and associates extended the investigation of tin bronzes to ternary alloys containing up to 8% aluminum. Porosity was reduced greatly and hot and cold working up to the solid solution limit was possible. Density decreased progressively with increase in aluminum content. They reported that 1% of aluminum had strengthening effects equivalent to 2% of tin. A comprehensive summary of this whole train of British investigations, starting several years ago, was also published (14-333, January 1947).

Two new bearing alloys with properties that compare favorably with those of the copper-tin-lead alloys were discussed by Grodsky (3-78, June 1946) and Eash (21-12, February 1946). According to Grodsky, a tin-free copper-base alloy containing phosphorus, nickel and lead has a low melting temperature and can be cast satisfactorily in green and dry-sand molds, but is especially suitable for pressure castings. It has high density and good machinability but is low in strength. The corrosion resistance is reported to be better than that of phosphor bronze. Eash developed a copper-base alloy containing nickel, lead, and antimony in which the tin content was reduced to 2%. He stated that this alloy has superior wearing qualities and equivalent compressive strength, but the ductility is lower than that of the 80-10-10 bronze. Mechanical properties, measured by conventional tests, of course, have little meaning for bearings.

Other Nonferrous Alloys

Vicalloy is a new, cobalt-base permanent magnet material, which, according to Nesbitt (3-46, April 1946), may be cold worked readily and is heat treatable. The cast alloy, after suitable heat treatment, has a magnetic energy product similar to a widely used K. S. magnet alloy. A similar alloy after severe cold working and heat treat-

ment has an energy product higher than that of Alnico II. In the form of tape, Vicalloy is used commercially for recording speech.

A new lead cable sheath alloy containing small quantities of arsenic, tin and bismuth, reported by Hickernell and Snyder (3-172, October 1946), is extrudable in the conventional apparatus, and the sheath is characterized by strong, tough welds, resistance to bending fatigue and creep, and excellent bursting strength. It has been successfully applied commercially.

Powder Metallurgy

Interest in the powder metallurgical processes continues at a high level, as is evidenced by the large attendance at any technical meeting devoted to the subject. The development of the underlying principles proceeds steadily. In a seminar on the theory of sintering, Rhines (5-53, October 1946) summarized the published experimental work on the factors affecting the sintering of pure metal powders, and developed a theory of sintering based on these results. He stated, however, that few of the major tenets of the theory are supported by direct experimental evidence, and suggested some of the research problems which require solution; among them are the effects of pressing on formation of bonds, and the investigation of plastic flow or diffusion during sintering. Only the effect of gases in causing dimensional changes of compacts during sintering seems to be firmly established. Seelig and Wulff (5-54, October 1946), as a result of an investigation of the pressing operation, conclude that high pressures are essential only very shortly before the maximum stroke of the press is reached, and that the method of feeding the powder to the die has a considerable effect on the size of the compacts. In discussing the progress of the art, Jones (5-35, July 1946) notes that there are no phase limitations in powder metallurgy, and suggests that a re-examination of constitutional diagrams by powder metallurgical methods may result in the development of vastly improved alloys.

Zvyangintsev (5-60, November 1946) prepared a series of platinum-iridium alloys, containing from 10 to 50% iridium, from powders. Diffusion experiments indicated that the formation of solid solutions is completed in relatively short intervals of time at temperatures as low as 1300° C. Similar alloys prepared by the usual melting process require 1900° C.

As a result of tests on copper-tin and copper-tungsten compacts made with ultrafine (2-micron) copper powder, Hausner (5-41, September 1946) concludes that fine powders assist in obtaining greater uniformity of shrinkage, higher density with lower compacting pressures, and high mechanical strength.

Steinitz (5-32, July 1946) describes a new nonferrous permanent magnet material composed of cobalt, copper and nickel. The alloy is sintered above the melting point of copper and is machinable after heat treatment. It has a magnetic value about two-thirds that of Alnico, but the coercive force is higher. The alloy is especially suitable for rotating magnets.

Other developments in nonferrous powder metallurgy may be listed: Disclosure of the development of a cupro-nickel alloy with controlled porosity which was used for de-icing aircraft during the war (5-35, July 1946); production of pure beryllium powder by reduction of the chloride with sodium vapor (5-28, July 1946); use of titanium hydride to protect compacts in a semihot pressing operation (5-26, June 1946); production of a copper-base, age hardenable alloy with good bearing properties (5-14, April 1946); investigations of the properties of ductile titanium (5-13, April 1946) and ductile zirconium (3-20, March 1946).

Technology of Aluminum and Magnesium

By L. W. Eastwood

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BY FAR the greatest advance in the aluminum and magnesium industries is the conversion from wartime to peacetime production. With the exception of aluminum forgings, the use of various forms of aluminum is approaching wartime levels. Thus, in March and April 1945 (the peak wartime months), approximately 155,000,000 lb. of wrought aluminum and aluminum alloys was produced per month, whereas present wrought production is near 140,000,000 lb. per month. Peak casting production amounted to approximately 43,000,000 lb. per month during the early part of 1945. This is now near 40,000,000 lb., but this conversion from wartime to peacetime operation is even more notable when it is realized that of the wartime production 8,000,000 to 9,000,000 lb. per month was in the form of air-cooled cylinder heads for aircraft motors, and the manufacture of these castings is now relatively small. All this means that the present use of aluminum is about 4½ times greater than the consumption immediately preceding the war.

Unlike the aluminum industry, magnesium production has been confined largely to aircraft motor and airframe parts. With such a narrow base, the magnesium sand casting output increased 55-fold during the war, and a month after V-J Day it dropped to 1.6% of the maximum wartime figure. Since then, magnesium casting production has increased steadily so that the present rate is about 6½ times that of the late 1930's, or 11.5% of the peak wartime output, excluding bomb castings. The present sheet and plate production is well above wartime levels, and is about 25 times that of the late thirties; production of extrusions is about 12 times. The wrought forms of magnesium have, therefore, undergone a tremendous expansion so that, at the present time, the tonnage of extrusions, sheet and plate is about equal to that of castings. Though the present tonnage of magnesium products is about 8½ times greater than that of the late thirties, the present production of magnesium products is now only about 1% of the present production of aluminum.


J.L. Everhart *L. W. Eastwood*

LaVerne W. Eastwood is in charge of much of the research currently being conducted on cast magnesium and aluminum alloys at Battelle and during the latter war period was associated with the Institute's work for the War Production Board, which led to several important developments in light metals foundry practice.

John L. Everhart has been engaged in research and development work on nonferrous metals for the better part of 20 years. In his work at Battelle, he has been particularly identified with studies on the impact extrusion of nonferrous metals.

Aluminum

In the technical literature the aluminum-magnesium-zinc alloys received greatest attention in the wrought field, but also had considerable development in the cast field (3-6, 1945 volume*).

*Literature references are designated by the corresponding item number in the Review of Metal Literature rather than by repeating the entire title, author and source; "1945 volume" refers to Volume II, 1945, of the Review of Metal Literature, assembled and bound from the monthly installments published in *Metals Review*.

These casting alloys without heat treatment produce tensile properties equivalent to those obtained in the heat treated aluminum-copper alloys such as No. 195. Their casting characteristics are somewhat similar to the 195 type also; namely, they tend to be hot short, although this is improved by the presence of about 0.5% iron. As compared with the 4% copper alloy (No. 195), aluminum-magnesium-zinc casting alloys are also somewhat more subject to shrinkage and, therefore, require better feeding. Their advantages lie not only in that heat treatment is unnecessary, but that the minimum melting temperature is high, making it possible to join them to other aluminum parts by the ordinary aluminum brazing technique. This operation can be carried out without damaging the properties of the castings if they re-age at room temperature.

Addition of beryllium to the aluminum-copper alloys has produced a new casting alloy containing 3.8% copper, 0.2% beryllium, and 1.3% cobalt (3-206, 1945 volume). This alloy requires a solution heat treatment after which it ages at room temperature quite rapidly. The reported tensile properties are superior to any of the other aluminum casting alloys, excepting those containing 10% magnesium.

In the wrought aluminum field, attention has been given to the improved tensile properties obtained by slightly cold working 24 S-T in the flattening operations in the mill, followed by an aging treatment of 16 hr. at 350° F., or 10 hr. at 375° F. (3-8, 1945 volume). This paper also describes the treatment and properties obtained in the aluminum-magnesium-zinc wrought alloys of the 75 S or R 303 type.

The dimensional stability of aluminum castings was the subject of an A.F.A. committee investigation (14-54, March 1946). While the report contains relatively little new information, it was noted that casting dimensions change as a result of (*a*) the relief of internal stress, and (*b*) growth produced by the precipitation of a constituent from a solid solution. Dimensional instability from both causes can be eliminated by an anneal up to 750° F., followed by slow cooling to room temperature. An annealing treatment at 750° F., however, does not produce the maximum tensile properties and, therefore, a compromise treatment at a lower temperature is usually employed whereby a good portion but not all of the internal stress or growth is eliminated, and the alloy retains nearly the maximum tensile properties.

Recrystallization of aluminum has been described in terms of rate of nucleation *N* and rate of growth *G* (4-12, 1945 volume); results of this investigation contribute considerably to the theory of recrystallization. There is, however, a considerable gap left between the theory expressed mathematically and the actual mechanism of recrystallization.

The Germans have studied the corrosion and stress-corrosion characteristics of some aluminum alloys (6-148, 1945 volume, and 6-45, June 1946). The susceptibility of the aluminum-magnesium-zinc alloys to stress-corrosion increases as the sum of the magnesium plus zinc increases, and an increase in zinc is particularly unfavorable. An alloy containing 4.5% zinc and 3.5% magnesium is outside the critical concentration range. These investigators also found that some small alloy additions to the aluminum-magnesium-zinc alloys improve their resistance to stress-corrosion. The optimum amounts were 0.1 to 0.4% chromium, 0.1 to 0.6% copper, 0.1 to 0.5% manganese, and 0.1% chromium or vanadium. Stress-corrosion was also the subject of a symposium in the United States (6-71, 1945 volume), which included one paper on the stress-corrosion of aluminum alloys and one on magnesium alloys.

Aluminum bearings are rapidly proving their worth (21-81, October 1946; 21-89 and 21-97, November 1946). Aluminum-tin alloys are considered to be the most desirable bearing compositions from the standpoint of antifriction characteristics and resistance to corrosion and lubricants. The presence of a third relatively hard constituent in the aluminum-tin alloys increases the load required to cause scuffing, reduces the coefficient of friction, and enhances wear resistance. Thus, Alcoa 750 alloy contains approximately 6.5% tin, 1% nickel, 1% copper, balance aluminum. Silicon additions (included in the XA 750 composition) also improve resistance to scuffing (a wrought aluminum-tin alloy, XA 80S, is also available in flat sheets). Among the advantages obtained from aluminum bearing alloys are long bearing life, high fatigue strength, high resistance to corrosion, high thermal conductivity, ability to withstand high bearing pressures, and simplicity and economy in fabrication. Binary aluminum-tin alloys are also steel-backed, and such bearings have better antifriction characteristics than the permanent mold cast XA 750 type. By one process, the aluminum-tin bearing alloy is cast against the steel backing in such a way as to provide a metallic bond between the aluminum alloy and the steel.

Centrifugal casting, as applied to aluminum, is definitely in the experimental and development stage, although good results have been reported for both the centrifugal and centrifuged methods (14-22, February 1946). The precision-refractory method of casting (14-103, May 1946) has the same limitation as that found in at least some plaster molds, namely, that the slow rate of solidification produces inferior properties. Aluminum alloys invariably tend to be less sound, coarser grained, and have coarser constituents with low solidification rates. As a result, the tensile properties are markedly lower than those obtained in sand molds where solidification is more rapid. Probably because the aluminum-magnesium-zinc casting alloys are essentially of the solid-solution type and contain relatively little insoluble constituent, the adverse effects of slow cooling are less pronounced than with the other common casting alloys containing a large amount of constituents or insoluble phases.

Magnesium

Gases in magnesium and microporosity received attention in a number of papers based on original research (3-175, 14-147, 14-177, 14-187, 14-247, 14-252, 14-354, all 1945 volume; and 3-45, April 1946; 14-133, June 1946; 14-216, September 1946). While the authors are not entirely in agreement—at least in respect to the emphasis placed on various factors — the information on microporosity may be summarized as follows: Any casting alloy which solidifies over a temperature range and does not have a substantial amount of liquid left for final solidification at constant temperature, tends to the formation of intergranular, more or less connecting, voids. Inadequate feeding caused by a lack of liquid metal to compensate for the solidification shrinkage will cause microporosity; evolution of a gas during solidification may also prevent feeding. Microporosity can be reduced by:

1. Selecting an alloy composition with a narrower solidification range or with more eutectic solidifying at the end.
2. Lowering the gas content of a melt.
3. Providing more directional solidification toward the risers by proper gating, risering, and chilling methods.

In general, the best results are obtained by applying all three of these remedies. The high-zinc alloys, such as AZ-63, are more susceptible to microporosity than the European alloys of the type A8 and AZ-91 containing approximately 0.4% zinc (3-7, February 1946). Degassing the melt will effectively decrease microporosity. The best method of doing this is to bubble chlorine through the magnesium melt at a temperature of 1300 to 1400° F. for 10 to 15 min., depending on the size of the melt. The third important factor, namely, the gating, risering, and chilling method employed, has not been given much recent attention in the literature, although it has been shown that microporosity is accentuated by inadequate feeding resulting from poor foundry practice (14-133, June 1946). It was also noted in this paper that the high-zinc alloys used in the United States are heat treated above their minimum burning temperatures, causing various degrees of damage to commercial castings.

A fact not generally realized is that the defect known as microporosity is by no means confined to magnesium-base alloys. The most common of the copper-base casting alloys and the high-

(Turn to page 51)

PRODUCTS AND PROCESSES

for the Nonferrous Industry

New Production Equipment, Improved Compositions, as Described by the Manufacturers

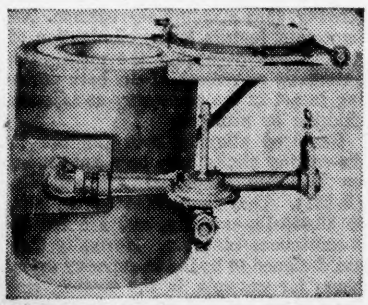
THERE ARE 2800 nonferrous foundries in the United States using crucible furnaces for melting brass, bronze, nickel, aluminum, and other metals and alloys. Crucible furnaces may be either stationary, using lift-out or pull-out crucibles, or tilting, in which the crucible remains in the furnace during its entire life. Any fuel—oil, gas, coal, coke, or electricity—may be used with crucible furnaces, and a variety of different alloys can be melted, simply by changing crucibles. These advantages are claimed in the fourth edition of the "Crucible Melters' Handbook" recently issued by the Crucible Manufacturers' Association (R-189)*.

Improved Crucible Furnaces

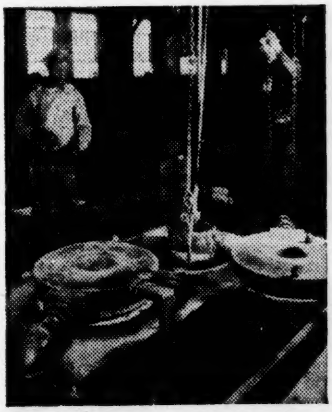
Four improved models of crucible furnaces, featuring rapid meltdown with low heat storage, have been put on the market during the past year by Eclipse Fuel Engineering Co. (R-190). The "RB" stationary furnace illustrated is designed for heavy foundry production in the melting of brass, bronze, aluminum and other alloys. This model has a roll-back cover and special McKee burners designed for high-production melting. Proper air-gas ratio adjustment is maintained by a McKee low-pressure proportional mixer.

The Eclipse "SB" model is a similar but smaller-capacity furnace with a swing-back cover and an entrainment-type burner which has a wide range of turndown. "HT" is a hand-tilting furnace with four burners so placed as to fire tangentially into the combustion chamber at the proper location in respect to the crucible. The fourth new model, designated "AL", is designed for melting of die-casting alloys and has a maximum operating temperature of 1300° F. Fuel consumption in all of these furnaces when melting brasses or similar alloys varies from 2200 to 2700 B.t.u. per lb.

*Further information about the products described may be secured by using the Reader Service Coupon on page 54, specifying the appropriate R-number, or by writing direct to the manufacturer at the address given on page 17.



Eclipse Model RB Crucible Furnace



Radiant Combustion Uses Two Crucibles in Tandem, Alternately Fired

A new top-fired crucible melting furnace, announced during the past year by Radiant Combustion, Inc. (R-191), holds two crucibles in tandem, loaded at all times and alternately fired. While the gas or oil flames are heating the first crucible, all of the flue gases produced are carried by a connecting flue to the second chamber to preheat the second crucible. During the pouring of metal from the first or fired crucible, a third crucible replaces it in the furnace to receive cold metal. The covers are cam-lifted and swung backward independent of one another, allowing each side to be alternately fired.

This combination of radiant and convection heat provides fast heating. Furthermore, burners cannot plug because they are in the top where slag or metal cannot reach them, and metal loss is low because the flame does not impinge on the metal. The metal is visible at all times and temperatures can be taken whenever desired without shutting off the burners. The lining is easy to replace since there are no burner ports to contend with. Flue gases can be vented through the floor, thus eliminating heat and gases in the foundry. Crucibles can be had in either the stationary or tilting types.

Use of preheated air is also incorporated in the design of the Iler crucible draw furnace manufactured by Fen Machine Co. (R-192). This furnace is divided, on an inclined plane through its middle, into two parts hinged at the back. The lower section contains the burners. A closed passage, built into the wall of the lower section, conducts the air from the blower to the burner. Traveling through this passage, the air picks up heat, returning it to the combustion chamber. The preheated air facilitates combustion, resulting in a short flame retained down and around the crucible. Savings of 20% in natural gas are reported, and a correspondingly greater saving where fuel oil is used.

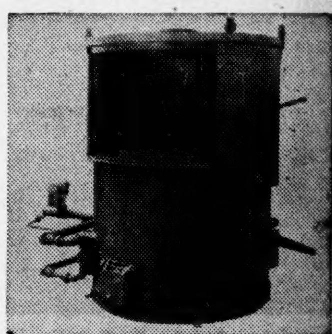
Raising or tilting the upper part of the furnace allows easy access for charging and removing the crucible. No tongs or overhead handling devices are required. A blower delivering 300 cu.ft. of air per min. at 13 oz. pressure is the only auxiliary equipment.

Pot Furnaces

Use of a ceramic crucible or an iron or steel pot is optional in a recently redesigned furnace for permanent mold casting, die casting, tinning and type founding. Made by Fisher Furnace Co. (R-193), this unit provides automatic temperature control for melting and holding aluminum, magnesium, zinc, tin and lead.

The combustion system uses low-pressure air supplied by a blower, and oil and gas burner equipment is of the proportioning type with 100% turndown. Complete turndown avoids overheating the metal and overshooting the control temperature. A flame protection safety device is available if desired in addition to the pilot light. Either potentiometer, millivoltmeter, or bulb-type pyrometer can be used.

The low metal loss and reduced drossing resulting from accurate heat control make this equipment especially



Fisher's White Metal Furnace

suitable for melting die-casting alloys and for remelting die-cast scrap. For casting lead slabs or refining type metals a bottom-pouring valve with swivel pouring spout is available. For lead, solder, and type metal, electric heating units can be supplied, as well as gas or oil burners.

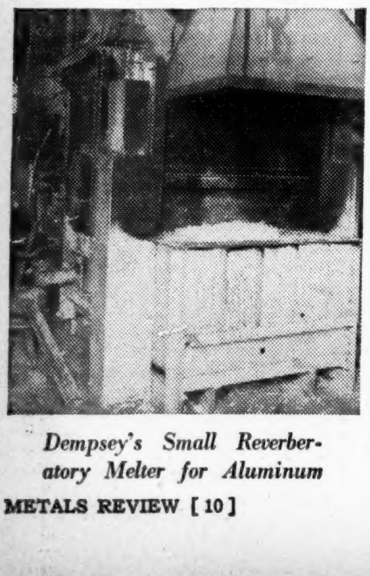
A removable pot furnace that will melt 600 lb. of lead in 29 min. has been announced by Johnson Gas Appliance Co. (R-194). It is equipped with six atmospheric fired bunsen burners, each having independent shut-off valve and pilot light. Pot temperatures up to 1500° F. are quickly reached with six burners and held at working level with three burners. Savings in both time and fuel are thus effected in melting such metals as lead, babbitt, tin, zinc, aluminum and type metal.

A new type of indirect-arc rocking electric furnace helps to insure metal of uniform quality by the automatic stirring provided by the rocking action, according to Detroit Electric Furnace Division of Kuhlman Electric Co. (R-195). An output of 900 lb. of bronze per hr. is claimed. This was described in *Metals Review* for December 1945.

A melting pot for aluminum, zinc, and other white metals, just announced by the Kindt-Collins Co. (R-196), has a 50-lb. capacity. The pot is cast from a special alloy, normalized to prevent cracking. As many as 200 heats can be obtained from each pot with reasonable care. Use of a two-man bail permits pouring of metal from the same pot in which it was melted. This minimizes agitation, reduces porosity, and encourages better castings.

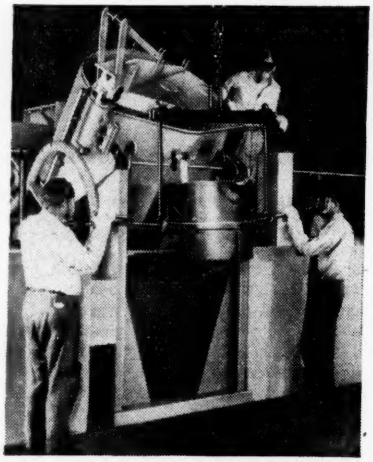
Reclamation of Scrap

Several innovations in furnaces for reclaiming scrap metals—particularly aluminum—have been reported during the past year. A wartime development of Intercontinental Engineers (R-197), kept confidential until recently, is a distillation furnace that operates at temperatures sufficiently high to vaporize zinc and many other metals. It thus can be used to separate brass into copper and zinc, and galvanized dross into commercially usable zinc and iron.



Dempsey's Small Reverberatory Melter for Aluminum

A dual unit of this type used to melt and condense zinc distilled from nickel silver was recently installed by Revere Copper and Brass, Inc. This is essentially an internally electrically heated retort and operates in the atmosphere of zinc vapor generated by the distillation temperature. The meltdown furnace carries a liquid pool of approximately 10,000 lb. into which the cold material is charged. Any foreign material, slag or dross is skimmed through a side door. At the end opposite the charging ports the metal runs through a teapot overflow in a relatively continuous stream to the distillation unit, which is kept at a temperature of approximately 3200° F. A liquid metal seal at the overflow end prevents the zinc vapors escaping from the distillation unit to the meltdown unit. The vestibule into which the metal is charged carries a protective atmosphere of nitrogen.

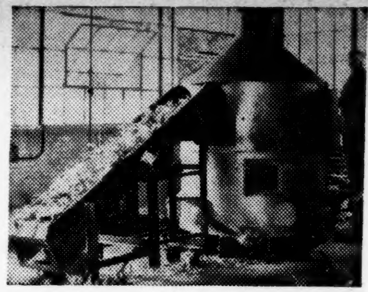


Ajax 125-Kw. Induction Furnace

The furnaces consist of a welded gas-tight steel tank with a one-piece removable roof. Hearth, sidewall and roof are of heavy carbon blocks backed up with fireclay brick and finally with insulation. The resistor element consists of a built-up grid made from graphite electrodes. The distilling or high-temperature furnace can be arranged so that molten metal from any source or from some other type of melting furnace can be charged.

Large reverberatory melters for reclamation of aluminum aircraft scrap were constructed during the past year by Dempsey Industrial Furnace Corp. (R-198). Parts from junked planes are charged through a large door onto a sloping or sweating hearth. Properly regulated heat melts the aluminum and allows it to drain away from the iron and other contaminating parts which remain on the soaking hearth and may be removed. The molten metal flows down the sloping hearth into a collecting bath where it may be cleaned, fluxed, and alloyed, if desired, before being cast into pigs in a continuous conveyer placed on one side.

Another reverberatory melter, shown in the photograph in the first column, is a small furnace designed to melt metal both in the form of pig and of scrap, to be cast into permanent molds and sand castings. Requiring but little space in the melting department, it delivers 500 lb. of aluminum per hr. for casting purposes. Use of a reverberatory furnace for such melting offers lower maintenance cost because of the elimination of iron pots conventionally used. It also eliminates the danger of contamination of the metal by the iron in the pots.



Gas-Fired Alloying Pot for Die-Casting Plants by Bellevue

Ajax Engineering Corp.'s new 125-kw. induction furnace (R-199) is especially designed for melting finely divided aluminum alloy particles like turnings, chips and unbaled foil. It is operated on the twin-coil induction principle. Oxidation losses are reduced considerably, and yields of 95 to 96% of the dry weight of the charge are obtained because of the rapid melting and the low temperature prevailing in the hearth during the melting operation.

The pouring spout is located exactly in line with the rotating axis of the furnace for direct pouring into molds. Tilting is accomplished by a hydraulic ram with a flexible chain and the arrangement is such that the furnace can easily be drained. The electric controls are concentrated in an internally wired, self-contained cubicle, which also houses the temperature control instrument. The supporting frame for the furnace and for the tilting ram is also self-contained, so that this melting unit does not require elaborate foundations.

Ajax also has a 20-kw. induction furnace for melting aluminum alloys in small quantities (R-200). Its principal use is as a holding furnace in die-casting and permanent mold plants. The bath is maintained under gentle stirring, thus avoiding segregation. An important feature is the elimination of fluxing and degassing the metal—the automatic movement of the bath seeming to act in the same way as injected chlorine or nitrogen.

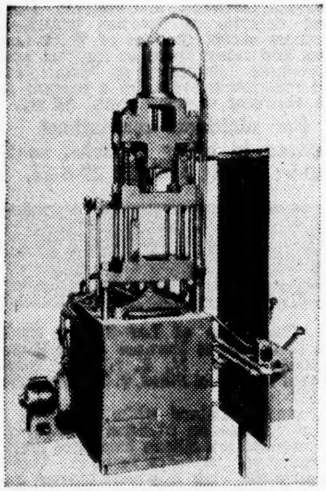
Gas-fired alloying pots for use in die-casting plants have been announced by Bellevue Industrial Furnace Co. (R-201). They range in size from 2000 to 10,000 lb. capacity, and are fed by a continuous conveyer. Normally they are designed to be fed to capacity every hour; for example, in the 6000-lb. size the material is fed to the furnace at the rate of 1000 lb. every 10 min., giv-

ing a total capacity of 6000 lb. per hr. They are used in die-casting plants for reclaiming sprues and other scrap material and can also be employed for alloying die-cast metal.

Die-Casting Machines

Various design changes leading to improved performance have been introduced by many of the leading die-casting equipment manufacturers. Two new machines for the production of large, heavy castings (HP-3½-SF for zinc, tin and lead alloys, and HP-3½-X-SF for aluminum, brass and magnesium) are products of Lester-Phoenix, Inc. (R-202).

The frame of both these machines is a one-piece steel casting. The locking pressure possible within this frame is rated at 600 tons. Dies are lowered through a long, wide opening in the top of the frame. The central die support has been increased in size, and the movable die plate has support on all four corners, minimizing possibility of deflection as the die is closed.



Kux Vertical Midget Die Caster

The machine for aluminum is equipped with the patented Lester prefill injection system, which injects metal rapidly at controlled speed and then applies the greatest pressure to the metal as it chills in the die. This equipment develops injection pressure of 33,000 psi., applied to castings up to 40 in. in projected area. Aluminum castings up to 14 lb. each can be made.

The hot metal injection system of the zinc machine has a one-piece cylinder and gooseneck casting of heat and corrosion resistant alloy, with a high speed steel cylinder liner and plunger. Furnace and pot are round, with tangential flames for faster, more uniform heating. Zinc castings up to 19 lb. each can be made on this machine.

Complete elimination of cold metal from the shot furnace, improved hydraulic performance, automatic timing and improved adjustable bearings for the movable platen are featured in Cleveland Automatic Machine Co.'s Model 400 (R-203). Basic design has not changed in the new model (including interchangeability of hot metal ends) but all toggle and pump mechanism is entirely enclosed in streamlined steel guards.

A double-compartment furnace on the zinc-tin-lead machine, with separate automatic burners for each compartment, does away with cold metal in the shot compartment. New metal is placed in the second compartment, automatically causing the overflow of readied molten metal into the shot section. Even temperature and uniform condition of the shot metal are maintained by this method.

Improved uniformity in hydraulic performance is achieved by addition of a new oil cooler. Heat absorption is augmented by fins on the outer shell which afford a high rate of heat radiation, and provide a combination of air and water cooling.

In two high-pressure machines produced by Hydraulic Press Mfg. Co. (R-204), mold clamping, metal injection, core-pulling and ejecting units are operated by direct hydraulic means. Injection capacities are from 12½ to 100 cu. in. per cycle. Injection pressures from 6000 to 50,000 psi. are available, depending upon plunger diameter. On the magnesium casting machine the plunger is actuated by a nitrogen accumulator, providing injection speeds up to 7200 in. per min. The aluminum machine employs straight-line hydraulics, the injection ram being directly connected to the Hydro-Power radial pump. Its maximum injection speed is 750 in. per min.

Built for water or oil-hydraulic operations, six sizes of cold chamber die-casting machines have been announced by Hydropress, Inc. (R-205). The machines are of horizontal design with vertically arranged injection chambers. A double-action valve for slow injection speed at the beginning, and a booster action for increasing the speed during progress of the injection, insure slow metal filling velocities and high final pressures.

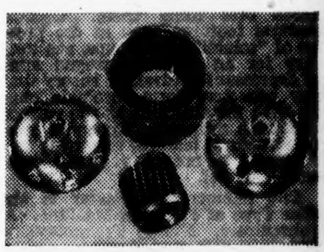
The "Work Horse" is the apt name given to its automatic, high-speed die-casting machine by Light Metal Machinery, Inc. (R-206). This equipment, designed for zinc, lead and tin, has a patented cycling mechanism that provides automatic die movement, shot and ejection in continuous cycles.

With single-cavity dies, operating speeds are listed as 240, 330, 520 and 720 shots per hr. Shot capacity of the machine is 16 oz., with a casting area of 30 sq. in. A small typical casting produced by users of the machine from a single-cavity die weighs ¾ oz. and was produced at 720 shots per hr. Largest casting produced weighs 9½ oz., run at 240 shots per hr. in a single-cavity die.

Using its latest model designed specifically for manufacturing small parts at high rates of speed, DCMT Sales Corp. claims record operational speeds up to 1500 shots per hr., using single-cavity molds (R-207). This high speed eliminates for the most part the necessity of using multiple-cavity dies.

DCMT also features use of prefabricated die sets in small machines that cost no more than a bandsaw (R-208). The machine can be set up in 2 to 3 min. for runs as small as 250 parts, thus making die casting readily available in any machine shop.

Kux Machine Co. has a new "midget" machine for high-speed operation (R-209) that comes in both horizontal (Model K5) and vertical types (Model K7). The 13-in. and 6-in. die space between the bars and 16½ x 9½-in. die plates permit perfect production of smaller die castings, weighing up to 1 lb. in zinc, under high injection pressures of 1500 psi. The machine has center shot operation, with the floating nozzle always in seated contact with the die and one-piece gooseneck. A perfect seal between plunger and gooseneck sleeve is maintained by expanding rings on plunger. Plunger and gooseneck sleeve are of nitrided steel. A double safety lock, one mechanical and one electrical, prevents a metal shot while die is in open position.



Aluminum Die-Cast Parts for an Electric Motor

H. L. Harvill Mfg. Co. (R-210) has a publication describing use of a machine with very high metal pressure (greater than 6000 psi.) for die casting electric motors made of aluminum. Separate operations are outlined for casting the rotor, the stator and the end bells. The multitude of small slots to be filled is indicated by the photograph; high pressure insures adequate filling and minimum porosity.

Continuous Casting

A major advancement in casting brass mill alloys during 1946 is Scovill Mfg. Co.'s development of the Rossi-type continuous casting of rectangular sections on a commercial basis (R-211). Basically, continuous casting is a process in which the liquid metal enters one end of a mold and emerges as solid metal at the other end, retaining the shape of the cross section of the mold.

In the reciprocating-mold process, the liquid metal is under-poured from a reservoir through a down-spout and discharged underneath the surface of the liquid metal in the mold. The mold moves down and up about ¾ in. in each direction with the down motion synchronized with the speed of the casting movement, and with the up-speed three times that of the down. The surface of the molten metal in the

(Turn to page 14)

A.S.M. Review of Current Metal Literature

An Annotated Survey of Engineering, Scientific and Industrial Journals and Books Here and Abroad, Received in the Library of Battelle Memorial Institute, Columbus, Ohio, During the Past Month

1 ORES & RAW MATERIALS Production; Beneficiation

1-1. Good Sinter and Its Production. T. W. Plante. *Blast Furnace and Steel Plant*, v. 34, Dec. 1946, p. 1515-1519.

Tests made by Jones & Laughlin on a number of sinters. These show reducibility of particle size, raw concentrate, and of sinters made from various starting materials and at different temperatures. Important points pertinent to production of good sinter. (To be continued.)

1-2. Chelate-Forming Organic Compounds as Flotation Reagents. G. Gutzeit. *Mining Technology*, v. 10, Nov. 1946, T.P. 2077, 15 p.

Reviews the chemistry of these compounds and gives results of a number of flotation tests on miscellaneous ores using them. Certain structural features, such as the presence of "solubilizing" groups, are necessary for an effective gangue mineral depressant. Advances theory that many collectors form insoluble chelates with metallic ions at the surface of floatable minerals. Appendix analyzes structural features imparting water affinity to metal-organic compounds. 46 ref.

1-3. The Submergence Factor in the Impeller Type of Flotation Machine. A. W. Fahrenwald. *Mining Technology*, v. 10, Nov. 1946, T.P. 2080, 8 p.

Results of experiments in which aeration, power, and impeller submergence are the related factors. To determine the relationship of these factors to metallurgical results, a special machine was built in which submergence was varied while other factors were held constant. In it, synthetic magnesite-quartz samples were floated.

1-4. Use of a Conductivity Cell for Flotation Reagent Control. J. F. Myers and F. M. Lewis. *Mining Technology*, v. 10, Nov. 1946, T.P. 2033, 4 p.

In the flotation of Tennessee Copper Co. sulphide ores, a variable quantity of unstable soluble salts, formed by oxidation, is present. The quantity of xanthate reagent must be varied in accordance with the quantity of these salts present. They can be readily determined by iodine titration. The human element has been eliminated by use of a conductivity cell and a recorder, since it was found that conductivity is essentially inversely proportional to soluble salt concentration.

1-5. Selective Media Concentration—a New Tool for the Mining Industry. Harry L. McNeill. *Mining Technology*, v. 10, Nov. 1946, T.P. 2084, 6 p.

Cut-away prints show the operation of the "selective-media" concentrator developed by Cleveland Cliffs Iron Co. and used for treatment of −⅜-in. ore at Calumet, Minn.; +⅜-in. ore is treated by the heavy density (ferrosilicon) process. The "selective-media" process requires no other media than a fraction of the ore itself. Machines produced 200,000 long wet tons of concentrates during the 1945 season. Table shows screen and chemical analyses of feed and products.

1-6. Influence of pH and the Crystalline Lattice Structure on the Action of Oxidizing Agents During Flotation of Minerals. I. N. Plaksine. *Reports of the Academy of Sciences of U.S.S.R.*, v. 54, no. 1, 1946, p. 47-48. (In Russian.)

Variation of flotability of sulphide minerals such as chalcopyrite, bornite, pyrite, galenite in lime media at pH's from 7.1 to 11.3.

1-7. Ore Treatment by Heavy-Media Separation. *Engineer*, v. 182, Dec. 6, 1946, p. 523-524.

Operation of the laboratory and the commercial continuous separation units developed by American Zinc, Lead and Smelting Co.

1-8. Development of a Hydrochloric Acid Process for the Production of Alumina From Clay. James I. Hoffman, Robert T. Leslie, Harold J. Caul, Lewis Jesse Clark, and John Drake Hoffman. *Journal of Research of the National Bureau of Standards*, v. 37, Dec. 1946, p. 409-428.

Process development and pilot plant construction. Process consists in roasting, digesting with dilute HCl, filtering, concentrating, precipitating the aluminum as a hydrated chloride by adding HCl gas, removing and washing the crystals, calcining to obtain alumina, and recovering HCl from the waste products. Pilot plant results show that the process is feasible but that costs are higher than present processes for production from bauxite.

1-9. Contributed Discussion on Cyanide and Regeneration Plant and Practice at Flin Flon. *Canadian Institute of Mining and Metallurgy Transactions*, v. 49, Dec. 1946, p. 604-606.

A complete description of the subsieve sizing apparatus mentioned in the paper printed in an earlier issue (v. 49, p. 130).

1-10. O'okiep—An Integrated Copper Mining Enterprise. M. D. Banghart and E. N. Pennebaker. *Engineering and Mining Journal*, v. 148, Jan. 1947, p. 79-83.

Mining and concentration practice at South Africa mine.

1-11. Making Tin Flotation Work—No. 3. Colquiri Ore. Part II. A. M. Gaudin and R. Schuhmann, Jr. *Engineering and Mining Journal*, v. 148, Jan. 1947, p. 84-87.

Experimental work on this Bolivian ore has resulted in development of an all-flotation process for concentrating cassiterite. This process includes water recovery, treatment, and re-use. With respect to nonsulphide mineral flotation, results indicate that selective flotation, rather than bulk flotation, can soon be applied.

1-12. A Process for Cleaning Molybdenite Concentrate. F. K. McKean. *Canadian Institute of Mining and Metallurgy Transactions*, v. 50, Jan. 1947, p. 36-48.

Trouble is often encountered in flotation of molybdenite, especially when the ore contains copper, bismuth, or antimony. Concentrate should contain less than 0.5% of these metals and over 90% MoS_2. A new process and flow sheet and description of the mill in Quebec where it is in operation. Essential feature is a heat treating or mild roasting step between two flotation steps. Possible application to other similar ores.

1-13. Classification at the Sullivan Concentrator. G. J. Knighton and W. Holdsworth. *Western Miner*, v. 20, Jan. 1947, p. 39-43.

This concentrator treats a complex lead-zinc-iron ore to make a lead and a zinc concentrate. Ore body consists typically of banded sulphides, mainly galena, sphalerite, pyrrhotite and pyrite. Gives flow sheets, descriptions of equipment, and results.

1-14. Principles of Flotation—Flotation of Cassiterite and Associated Minerals. H. F. A. Hergot, J. Rogers and K. L. Sutherland. *Mining Technology*, v. 11, Jan. 1947, T.P. 2081, 18 p.

Use of sulphated and sulphonated paraffin chain compounds for cassiterite flotation was studied using the captive-bubble technique. From these data, the separation and concentration of tin was investigated by flotation tests in a 2000-g. Denver cell.

1-15. Principles of Flotation—Activation of Minerals and Adsorption of Collectors. J. Rogers and K. L. Sutherland. *Mining Technology*, v. 11, Jan. 1947, T.P. 2082, 17 p.

Relationships between collector and mineral; activator and mineral; and activator, collector, and mineral. Current theories of flotation criticized. Authors accept theories of Work and Cox and reject those of Taggart and coworkers. Summary of "principles" for determining value of a reagent as an activator or depressant. 31 ref.

For additional annotations indexed in other sections, see: 10-9; 19-18; 26-6-12; 27-6-23.

2 SMELTING AND REFINING

2-1. Production of Low-Silicon Basic Iron in the Blast Furnace Using High-Magnesia Slags. M. E. Nickel. *Blast Furnace and Steel Plant*, v. 34, Dec. 1946, p. 1522-1526.

Results obtained while operating a blast furnace on high-magnesia slags to produce low-silicon basic hot metal directly in the blast furnace. While insufficient work has been carried out to substantiate any definite conclusions, results indicate that economic production can be carried out with normal furnace operation.

2-2. The Effect of Cell Variables on the Electrowinning of Manganese. J. H. Jacobs. *Electrochemical Society Preprint* 90-35, 1946, 10 p.

An electrolytic manganese pilot plant having a daily capacity of 2000 lb. has been operated by the Bureau of Mines for the past 5 years. Results recorded are on the effect of certain variables on the electrodeposition of manganese, namely, electrode spacing, rate of feed to the cells, manganese concentration in the cell catholyte, and length of cell operation before cleaning.

2-3. Automatic Control of Soaking Pits. C. H. Stone. *Metallurgia*, v. 35, Nov. 1946, p. 18-22.

Requirements of soaking pits, their design and type according to the fuel to be used. Particular attention is directed to the heating cycle with the object of instituting controlled conditions in the pits to facilitate work in the mill.

2-4. Electronic-Frequency-Converting Equipment Used for Production Melting of Alloy Steels. *Industrial Heating*, v. 13, Dec. 1946, p. 1990, 1992.

Installation includes a 300-kw. electronic frequency changer; a steel tank mercury-arc converter equipped with vacuum pumps; a transformer to which three-phase, 60-cycle power is supplied through a standard metal-enclosed oil circuit breaker at 6900 volts; two induction melting furnaces, each capable of melting 650 lb. of steel,

but so constructed that coils for melting 1000 lb. can be substituted in the future.

2-5. Fluidity of Converter and Electric Steels. *Iron Age,* v. 158, Dec. 26, 1946, p. 65.

Relationship between temperature and fluidity of converter and electric furnace steels. One of the conclusions reached was that temperature rather than steelmaking method is the deciding factor in fluidity. Support of this statement was found in a report describing the use of a spiral to which was attached a pouring basin, making it suitable for bottom-poured ladles. (Account of first technical convention of the British Steel Founder's Assoc. at Sheffield, England.)

2-6. Production of Low-Silicon Basic Iron in the Blast Furnace Using High Magnesia Slags. M. E. Nickel. *Blast Furnace and Steel Plant,* v. 34, Dec. 1946, p. 1522-1526.

Results obtained indicate tentatively that use of the high magnesia slag will permit economic production with normal furnace operation.

2-7. Thermal Production of Magnesium. L. M. Pidgeon. *Canadian Institute of Mining and Metallurgy Transactions,* v. 49, Dec. 1946, p. 621-635.

Small-scale experiments on various direct reduction reactions leading to choice of the ferrosilicon reduction of dolomite, and the realization that this reaction would proceed at a satisfactory rate at temperatures obtainable in metal apparatus.

2-8. Graphite Molds for Casting Vertical Steel Ingots. S. W. House and T. Killman. *Iron Age,* v. 159, Jan. 16, 1947, p. 59-63.

Experiences encountered by the Texas Steel Co. in producing a total of 538 steel ingots, in a single vertical graphite mold (two-part design). In addition to the metallurgical advantage of producing steel with a more homogeneous structure than can be obtained with an iron mold, several economic advantages, such as reductions in mold cost, labor (stripping cost), and ingot surface conditioning costs were also realized.

2-9. Outokumpu's Copper Smelter Doubles Output During War. P. Bryk, K. I. Levanto, Eero Makinen, and John Ryselin. *Engineering and Mining Journal,* v. 148, Jan. 1947, p. 68-72.

Operations at Finnish smelters.

2-10. Iron Substitutes in Openhearth Charges. R. R. Fayles. *Iron Age,* v. 159, Jan. 23, 1947, p. 57-59.

Various carbonaceous materials available; successful utilization of a combination of anthracite coal and byproduct coke.

2-11. Electric Furnace Practices for Melting Openhearth Grades of Carbon Steel. Charles W. Briggs. *Metal Progress,* v. 51, Jan. 1947, p. 71-75.

Outlines some of the papers presented at the December 1946 meeting of A.I.M.E. held in Pittsburgh. Electric furnace electrodes; scrap distribution; basic electric oxidizing period; rimmed basic steel and semikilled electric steel; argon gas used in steel melting; acid electric slags; sulphur and what can be done about it; metallurgy of quality steel.

For additional annotations indexed in other sections, see:

1-8; **3**-4-16; **16**-3-4-5-11; **17**-2-5; **25**-9; **27**-10-12-20.

3 PROPERTIES OF METALS AND ALLOYS

3-1. A New Radar Transformer Steel. G. H. Cole and R. S. Burns. *Materials & Methods,* v. 24, Dec. 1946, p. 1457-1460.

New magnetic alloy developed during the war specifically to increase the effectiveness of radar pulse transformers. Has a carbon content of less than 0.01%. Properties, characteristics and peacetime applications.

3-2. Nickel and High-Nickel Alloys. Norman E. Woldman. *Materials & Methods,* v. 24, Dec. 1946, p. 1475-1490.

Various wrought nickels and nickel alloys, and the best and most up-to-date practices for welding, cleaning, finishing, machining and otherwise processing this important group of engineering materials. Tables list various properties.

3-3. The Mechanical Properties, Including Creep, of Aluminum Bronzes at Elevated Temperatures. E. Voce. *Metallurgia,* v. 35, Nov. 1946, p. 3-9.

Creep results for tin bronze, gun metals, and a copper-silicon-manganese alloy show that the tin-bearing alloys are much inferior to the aluminum bronzes in their resistance to creep and, while the silicon alloy appears to be slightly superior at 400° C., this material is handicapped by relatively large initial extensions. For such reasons, and because of their great resistance to oxidation and scaling, the aluminum bronzes appear to be the most promising of the copper-base alloys for service at moderately elevated temperatures.

3-4. Magnesium Casting Alloys—Their Production and Use. G. B. Partridge. *Metallurgia,* v. 35, Nov. 1946, p. 13-17.

First of series outlines British recovery process, various alloys of magnesium and their macrostructure, and compositions and properties of British commercial alloys. Composition and properties of a number of magnesium alloy sand and gravity die castings. (To be continued.)

3-5. Magnesium-Cerium-Zirconium Alloys: Properties at Elevated Temperatures. A. J. Murphy and R. J. M. Payne. *Journal of the Institute of Metals,* v. 73, Nov. 1946, p. 105-127.

By the addition of zirconium to magnesium-base alloys, alloys are obtained which have mechanical characteristics at room temperature comparable to those of the usual casting alloys Elektron A8 and AZ91, but possessing resistance to creep of a far higher order. When tested at 200° C., the creep resistance of certain of the magnesium-cerium-zirconium alloys is very little inferior to that of the widely used aluminum alloys of the type covered by specifications D.T.D. 133c and 287. The combination of good casting qualities and good mechanical properties at ordinary and elevated temperatures makes the magnesium-cerium-zirconium alloys attractive for some important light-weight stressed components of engines.

3-6. Influence of Structure and Composition of Alloys on Their Mechanical Properties. Y. B. Fridman. *Engineers' Digest,* v. 3, Nov. 1946, p. 579-580.

Analyzes influence of such factors as grain size, distribution of solid solutions, intercrystalline brittleness and tempering temperatures on the mechanical properties of metals under varying conditions, including extreme low temperatures. Treats the latter in a novel manner. (Condensed from *Vestnik Inzhenerov i Tehnikov,* no. 2, 1946, p. 44-50.)

3-7. Physical Properties of Steel Control Cable. C. W. Meyers. *Automotive and Aviation Industries,* v. 95, Dec. 15, 1946, p. 44-45, 62, 64.

Wartime development of a flexible steel aircraft control cable having a coefficient of linear expansion practically the same as that of the aluminum alloy airframe. Coefficient of expansion; modulus of elasticity; AE value (relation between load and stretch); magnetic permeability; breaking weight; fatigue properties.

3-8. Metallic Film Formation at Low Temperatures. A. Goetz, E. L. Armi, M. G. Foster, and A. B. C. Anderson. *Chemical Reviews,* v. 39, Dec. 1946, p. 481-495.

Apparatus and method for condensing thin films from a molecular beam of pure lead at temperatures down to 14° absolute. Electric conductivity of these films was measured during and after exposure to the beam. Onset of conductivity depends upon temperature of the film formation. Changes occurring in the films after exposure. 15 ref.

3-9. Recherches sur la Variation de la Resilience de l'Acier au Carbone Moule, d'Elaboration Electrique Basique. (Investigation of the Impact Value (Strength) Variation of Cast Carbon Steel.) P. Bastien and L. Alanore. *Comptes Rendus,* v. 223, Oct. 21, 1946, p. 631-632.

One hundred and thirty-three different cast carbon steel test specimens were investigated to determine the influence of sulphur, phosphorus, manganese, carbon on impact strength.

3-10. The Statistical Aspect of Fatigue of Materials. A. M. Freudenthal. *Proceedings of the Royal Society,* v. 187, Dec. 13, 1946, p. 416-429.

This phenomenon is the result of progressive destruction of the cohesive bonds as a result of the repetitive action of an external load. It has the typical features of a mass phenomenon. By applying the fundamental rules of the theory of probability, many of the experimentally established relations between the principal variables can be theoretically deduced from the purely formal assumption of the existence of a statistical distribution function of the separation-strength of cohesive bonds. 18 ref.

3-11. Electric Steel Sheets. (Concluded.) J. S. Vatchagandhy and G. P. Contractor. *Iron and Steel,* v. 19, Dec. 1946, p. 798-800.

Grain size and orientation; permeability; physical characteristics. Results of various tests shown in tables. 11 ref.

3-12. Metallic Carbides and Hard Alloys. W. G. Cass. *Industrial Diamond Review,* v. 6, Dec. 1946, p. 376-378.

Recent work in Russia and France reviewed.

3-13. Deformation in Relation to Time, Pressure and Temperature. P. G. Nutting. *Journal of the Franklin Institute,* v. 242, Dec. 1946, p. 449-458.

The derived deformation and energy functions are applied to some experimental data on steel tape which include thermal and relaxation observations. Thermodynamic relations governing both elastic and viscous behavior are developed.

3-14. Nyare Svenska rön Beträffande Stals Aldring. (Results of Recent Swedish Investigations on Aging of Steel.) B. D. Enlund. *Jernkontorets Annaler,* v. 130, no. 10, 1946, p. 553-574.

Investigations indicate that aging takes place in all mild steels after straining. This appears in the form of increasing hardness, yield point, ultimate strength, and sometimes brittleness. The latter is modified by the structural state and composition of the steel. Aluminum addition reduces age hardness and brittleness. Steels embrittled by straining and aging have comparatively good impact tenacity above 100° C., and may be restored to normal tenacity by annealing at 600 to 650° C. This treatment is shown to be useful as a final procedure in manufacture of various forgings.

3-15. Nyare Utländska rön Beträffande Aldring i Mjukt Stal. (Results of Investigations in Foreign Countries on Aging of Mild Steel.) Axel Hultgren. *Jernkontorets Annaler,* v. 130, no. 10, 1946, p. 575-592; discussion, p. 592-598.

Reviews results published in foreign technical literature during the last ten years regarding quench aging and strain aging of mild steel. 15 ref.

(Turn to page 16)

mold is protected from oxidation by a reducing atmosphere. For mold lubrication, oil is applied continually to the top of the molten metal where it spreads to the edges of the special water-cooled copper mold.

Commercial advantages of flat metal bar stock processed by continuous casting include: *(a)* more uniform chemical composition, *(b)* minimum of segregation in duplex-phase alloys, *(c)* freedom from shrinkage porosity, *(d)* freedom from slag inclusions, and *(e)* considerably longer coils (up to capacity of rolling mill equipment) for cold rolled brass strip.

Foundry Equipment

A metal reclaiming mill manufactured by Dreisbach Engineering Corp. (R-212) is a useful foundry adjunct for reclaiming metal from nonferrous cinders, slags, skimmings, spills and sweepings. This mill is a complete unit for grinding all waste material, including sand, to 4-in. pieces, separating and concentrating all metal by specific gravity, and removing all pulverized waste into the settling tanks as the water recirculates through the mill. It is of all-welded steel construction. The water chambers fill and empty inside of the mill drum, causing a continuous flow and eliminating a recirculating pump.

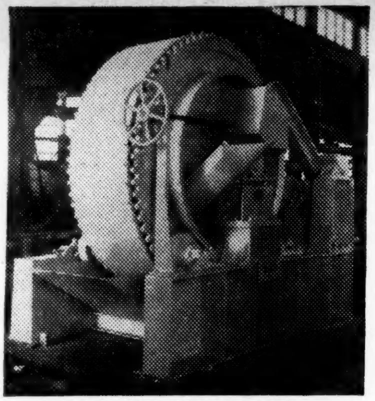
These mills are made in four sizes, suitable for 400 to 6000 lb. per hr. Settling tanks are furnished with each, one for the smaller sizes and two each for the larger sizes. Sludge may be removed manually or by an automatic drive to dewater and discharge it into a steel drum or onto a conveyer belt. Feeding is manual, or by a special drum lift and dump or bucket elevator. Power handling is recommended for the larger sizes. No pits or sumps are required in the installation.

An improved exothermic feeding compound for all nonferrous alloys is Foseco Feedol, a product of Foundry Services, Inc. (R-213). This antipiping compound contains heat-generating substances adjusted so as to give rapid or delayed action according to the requirements of the casting and the alloy from which it is poured.

Not only does this compound do away with the necessity of rod feeding, but frequently allows a substantial reduction in the volume of the riser. The compound, in a cone-shaped container, is placed in the riser before casting starts. The rising metal burns away the container and the feeding compound covers the surface with a minimum loss of time.

Another Foundry Service product is Dycoat (R-214), a line of refractory materials used for coating the casting cavity, runners and risers in permanent mold casting. These materials improve surface finish of the casting, act as a lubricant for easy removal from the die and, when coated heavily on thin sections of the mold and spread lightly on heavy sections (differential coating), equalize the rate at which the metal solidifies.

Simultaneous degassing and grain



Metal Reclaiming Mill

refining of aluminum alloys are accomplished by Foseco's new De-Gaser No. 8. This is a concentrated compound placed on the center of the melt and slowly plunged into the liquid metal using a coated plunger. Grain refinement is accomplished by evolution of boron compounds within the melt.

Divco Metal Rectifier, manufactured by Division Lead Co. (R-215), is a product designed for minimizing contamination of lead heat treating baths. It operates equally well in tin, solder, and lead alloy melting pots. By treating the lead pot with this rectifier at regular intervals, imperfect heat treating and lead losses can be kept to a minimum. It is simple to use, cleanses the pot of any trouble-forming impurities and restores it to its original efficiency.

New Alloys

Few outstanding new compositions of nonferrous alloys have been announced during the past year, most developments in the industry being along the line of unusual applications. These products will be described in the August issue of *Metals Review*, which will feature "Industrial Uses and Design". Several new alloys for which manufacturers claim exceptional properties, however, are mentioned in the following paragraphs.

A series of aluminum-base alloys containing magnesium and zinc is designated by National Smelting Co. as Ternalloys (R-216). In each of these the presence of an aluminum-magnesium-zinc phase or compound, together with other alloying elements carefully proportioned, affords high strength without recourse to heat treatment. Other advantages are dimensional stability, excellent machinability, good polishing characteristics and good corrosion resistance.

Marked changes in physical properties occur in these alloys with small changes of magnesium and zinc content, and, therefore, a number of alloys have been developed in the series. Their high strength without heat treatment is helpful to foundrymen who would like to produce castings for highly stressed applications but who do not want to install the expensive heat treating equipment ordinarily required. Where applications require the absolute maximum of the alloy without a time interval for room temperature aging, Ternalloy 7 or 8 may be used with a solution heat treatment.

The Ternalloys are used in some applications for their excellent machinability. They are fine grained and take a high polish to a pleasing silvery color. They have good corrosion resistance and somewhat better castability than other alloys in the aluminum-magnesium-zinc system. Full information, including charts and specifications, is contained in a 12-page illustrated bulletin.

A tin-conserving substitute for phosphor bronze developed during the war is Bridgeport Brass Co.'s Alloy 712 (R-217). This is an aluminum bronze intended to replace the phosphor bronze formerly almost universally used for electrical switch parts and similar items which must possess suitable spring characteristics and withstand many thousands of deflections without failure.

Alloy 712 contains about 95% copper, 3.5% aluminum, and 1.0% silicon. It has similar characteristics to Grade C phosphor bronze and has been successfully used in place of the latter for spring contacts, diaphragms, metal bellows and spring bearings. Its fatigue resistance, dependable spring properties and toughness indicate a wide range of applications in switches, relays, capacitors, jack plugs, temperature controls, fountain pen and pencil clips and similar parts. Alloy 712 is slightly lower in electrical conductivity than phosphor bronze Grade C and is about 1% lighter in weight than the latter.

A new type of bronze developed by Olds Alloys Co. for conveyer chain is known as Oldsmoloy (R-218). It is a chromium-nickel-molybdenum bronze of silvery white color, which exhibits marked resistance to corrosion by most chemicals.

Produced as chain links in the as-cast condition, Oldsmoloy has an average tensile strength of 80,000 psi. with elongation of 12 to 18% in 2 in. It is strongly resistant to salt spray corrosion, and has withstood the attack of 20° Baumé, boiling sulphuric acid for periods of ten days with less than 0.5% loss of weight.

Those interested in copper would doubtless find a compilation of information on weldability of 313 copper-base alloys, just issued by Ampco Metal, Inc., a handy thing to have in the files (R-219). This set of 19 mimeographed sheets gives trade names, manufacturers and chemical composition of most of the established copper-base alloys, together with such welding information as degree of weldability, preheats, type of electrodes or rods recommended, and the preferred welding process.

New developments in the noble metal field have been notable in the high-strength, flexible and springy karat gold alloys for special purposes in jewelry, according to Thomas J. Dee &

Co. (R-220). By addition of a few per cent of the platinum metals, this company produces 10 and 14-karat gold alloys which are highly tarnish resistant and yet have a tensile strength of over 150,000 psi. By suitable heat treatments these alloys may be made highly elastic.

High-strength alloys (140,000 psi. or more) can also be produced with a palladium-silver alloy base providing excellent resistance to tarnish.

Because of the low modulus of elasticity and the relatively high elastic limit after heat treatment these noble metal alloys exhibit a remarkable bending capacity without permanent deformation. They may be readily formed by cold working in the annealed state where the yield strength is about half that of the same alloy in the heat treated condition.

Gas-free metals made by high-vacuum techniques have recently been offered to industry in limited quantity for experimental work by National Research Corp. (R-221). Vacuum metallurgy embraces a wide range of operations including: *(a)* melting, degassing, and casting; *(b)* vaporization and distillation; *(c)* heat treatment of special surfaces.

Almost every nongaseous element in the periodic table (including some nonmetals) will respond to vacuum treatment. Many elements have been experimentally treated, and a partial list of metals observed includes copper, nickel, iron, chromium, manganese, lithium, sodium, magnesium, calcium, and zinc—which are easily vaporized and produced in pure form.

National Research's equipment permits melts from a few grams up to several hundred pounds capacity at pressures between 10^{-4} and 10^{-2} mm. of mercury. Upon demand considerably larger melts can be undertaken.

Among recent products, announced by Metal Hydrides, Inc., is a master alloy of zirconium and magnesium containing 60% zirconium which facilitates the addition of zirconium to molten magnesium (R-222). (Zirconium formerly could be added only by the use of inorganic salts which were expensive as well as wasteful.) The resulting alloy contains approximately 0.5% zirconium and contributes considerably to grain refinement of magnesium, as well as increasing strength and corrosion resistance.

Addition of titanium to a chromium-copper alloy has found use in the form of wire for spraying on glass to facilitate the seal of glass to metal (R-223). In bronze alloys titanium decreases porosity and, consequently, improves density and eliminates rejects of complicated castings. Zirconium added to copper increases the tensile strength without materially decreasing the conductivity.

Hydrides of the elements titanium and zirconium have been produced on a large scale and used in the electronic and metallurgical industry in various capacities (R-224). Small quantities of titanium hydride in mercury boilers reduce the solubility product of the reaction between mercury and iron. It is used in powder metallurgy compacts where, upon heat treating, the hydride decomposes into nascent hydrogen and pure metal; in this way oxide films are destroyed and the titanium remains behind to provide beneficial alloying results. Zirconium hydride has found considerable use in the electronic industry as a getter in certain types of vacuum tubes.

Large-scale production and a new low price on calcium hydride was established in 1946 by Metal Hydrides (R-225). Uses have been developed for this material as a drying agent for such materials as transformer oils, carbon tetrachloride, and nitrogen and hydrogen gases in heat treating furnaces and nitriding equipment.

Powder Metal

Commercial production of molybdenum in "chunks" of large size and multiplicity of shapes has been achieved this year by Westinghouse (R-226). Since molybdenum melts at 4748° F., it cannot be cast like other metals to form large solid pieces, but must be compacted by powder metallurgy means. The new Westinghouse process removes the restrictions of both size and shape and permits manufacture of pieces in any shape that can be molded. It can be round, square, with fins, angles, or holes and with much larger over-all dimensions than heretofore possible. Cost per pound is reduced to roughly one-third.

Several years' research in the laboratories of Callite Tungsten Corp. on the development, production and application of sintered high-density tungsten alloys has come to fruition in three new materials—Alloy 112, which contains approximately 85 to 90% tungsten; Alloy 125, substantially pure tungsten; and Alloy 225, substantially pure molybdenum (R-227).

Alloy 112, a heavy alloy, is particularly suited for balancing weights where space is at a premium, as, for example, in balancing weights for controlling pitch in air screws, for centrifugal clutch plates, for rotors in gyroscopic devices. Because of its high density, it may also be used for a container for radioactive substances and as an absorption screen for radioactive radiations and X-rays. As shown in the table of physical properties below, density after sintering is 99½% of theoretical.

Alloy 112 is readily machinable and can be shaped, drilled, tapped in much the same fashion as a good grade of cast iron. At elevated temperatures it oxidizes slowly; at ordinary room temperatures it resists atmospheric corrosion almost completely. It can be silver soldered and brazed by conventional techniques.

Both alloys 125 and 225 can be shaped before the final sintering. Final high-temperature heat treatment will induce maximum density. Alloy 125 is considerably harder than Alloy 225 and cannot be machined. It can, however, be ground and polished, using Crystolon grinding wheel No. 37100-17.

Alloy 125 (tungsten) can be sintered to shape and can be made in fairly large sections not ordinarily procurable, such as crucibles for high-temperature work, special vacuum containers, electrodes for melting glass, and special shaped electrical contacts of large areas. Alloy 225 (molybdenum) is somewhat softer than Alloy 125 and can be machined with high speed steel or carbide-tipped tools. It is used where extremely high temperatures are not required; otherwise, it has generally the same applications as the tungsten alloy.

Fansteel? Indar Corp. has announced a hydrogen-reduced molybdenum powder of highest purity and very fine particle size (R-228). In addition a tungsten carbide powder has been developed which is extremely low in free carbon and has a small particle size. The powder is suited for manufacture of carbide cutting tool materials and similar applications. The tungsten carbide powder can also be supplied premixed with any desired proportion of cobalt to give a homogeneously blended mixture.

Hydrogen-reduced cobalt in the form of powder, rondelles, and oxide with a guaranteed purity of 99.9+% is now available from Reduction and Refining Co. (R-229). Because of its high purity and particle size control, it is especially well adapted to use in tungsten carbide tools and dies and permanent magnets.

Plastic Metals Division of the National Radiator Co. has added nickel powder to its line of products (R-230). This material, sold under the tradename Plast-Nickel, is a pure powder with the nickel content normally somewhat more than 99%. Oxygen in the form of surface oxide is the major impurity.

This high-purity nickel powder is available in any standard mesh from 8 to minus 325. It is prepared to specified screen analyses when necessary. While the powder particles are fairly soft and compactible, they can be made even more so by special processing methods. Apparent density of Plast-

(*Turn to page 17*)

Physical Properties of Tungsten Alloy 112

	Alloy 112 P-2[1]	Alloy 112 E[2]
Tensile strength	60 to 80,000 psi.	70 to 90,000 psi.
Elongation in 2 in.	1 to 2%	½ to 1½%
Brinell hardness	240 to 280	240 to 280
Coefficient of expansion (75 to 1600° F.)	3.78×10^{-6}	3.22×10^{-6}
Theoretical density	17.3	17.5
Density after sintering	16.8 to 17.2	16.8 to 17.4
Sintering temperature	2500° F.	2460° F.

[1]90% tungsten, 6% nickel, 4% copper
[2]90% tungsten, 10% cobalt plus silver

[illegible] **Flow of Molten Metals in an Open Channel.** E. J. Ravinovitch. *Reports of Academy of Sciences of U.S.S.R.*, v. 54, no. 3, 1946, p. 201-203. (In Russian.)

Mechanism was investigated using a specially developed measuring apparatus. Data obtained are presented in the form of diagrams, showing that the mechanism of the molten metal flow under turbulent conditions does not differ from any common liquid turbulent flow.

3-17. Strength and Ductility. Maxwell Gensamer. Pennsylvania State College, School of Mineral Industries, Technical Paper 113, 1946, 60 p.

Efforts to understand the relationships among the measured mechanical properties of metals and their mechanical behavior in service, and the way in which these properties and service characteristics are controlled by chemical composition and structure. (Reprinted from *Transactions of the American Society for Metals*, v. 36, 1946, p. 30-60.) 11 ref.

3-18. Which Cast Steel? Part II. E. J. Wellauer. *Machine Design*, v. 19, Jan. 1947, p. 111-117.

Commercially available cast steels. Tables give properties and specifications.

3-19. Aluminum Alloy 75S. *Machine Design*, v. 19, Jan. 1947, p. 143-145.

Properties; physical constants; characteristics; applications; fabrication; heat treatments; resistance to corrosion; galvanic corrosion; corrosion resistant finishes; material designations.

3-20. Magnetoresistance and Domain Theory of Iron-Nickel Alloys. R. M. Bozorth. *Physical Review*, v. 70, Dec. 1 and 15, 1946, p. 923-932.

Measurements of change of electrical resistivity with magnetization and with tension are reported for iron-nickel alloys containing 40 to 100% nickel. Measurements are made in transverse as well as longitudinal magnetic fields, and the difference between the resistance so measured is independent of the distribution of domains in the unmagnetized state. 15 ref.

3-21. Activation of Metallic Copper by Oxidation and Reduction. W. E. Garner and F. S. Stone. *Nature*, v. 158, Dec. 21, 1946, p. 909.

The activation of copper by repeated oxidation and reduction results in a great increase in surface area. This phenomenon studied using both H_2 and CO. Essential differences were found which shed light on the mechanisms involved.

3-22. Low-Alloy, High-Tensile Steels, Their Properties, Workability and Weldability. George M. Huck. *Welding Journal*, v. 26, Jan. 1947, p. 32-35.

The development of these steels, with special reference to the "Mayari R" steel produced by Bethlehem.

3-23. Flakes in Welds. M. Lefevre. *Welding Journal*, v. 26, Jan. 1947, p. 57s-64s.

This defect appears in steels and weld metal; conditions and causes for its development; remedies; references to the literature on the subject. Concludes that absorption of hydrogen is the major cause of flakes. Experimental results indicate that flakes can usually be eliminated either by several weeks or months' aging, or by heat treatment at 480° F. for a couple of hours. 14 ref.

For additional annotations indexed in other sections, see:

4-1-7; 9-2-3-6; 12-14; 18-9-18; 19-29; 22-24-36; 23-17; 24-7; 25-9; 27-9-17-26.

4 STRUCTURE — Metallography & Constitution

4-1. Carbon Absorption of 18-8 at High Temperatures. Wilson G. Hubbell. *Steel*, v. 119, Dec. 30, 1946, p. 86, 88, 90.

In spite of carbon pickup and the formation of structures containing precipitated carbides, intergranular corrosion does not occur nor is failure of parts due to these causes.

4-2. Grain Boundaries in Metals. P. J. E. Forsyth, G. J. Metcalfe, R. King, and B. Chalmers. *Nature*, v. 158, Dec. 14, 1946, p. 875-876.

Theory of structure of these boundaries. Photomicrographs of copper-beryllium alloys and of an aluminum-magnesium alloy illustrate differences in the way in which precipitation occurs. Formation of boundary grooves on polished metal surfaces at elevated temperatures.

4-3. Sur la Production de Fissures dans l'Aluminium au Cours de la Solidification. (Formation of Fissures in Aluminum During Its Solidification.) H. Jolivet and M. Armand. *Comptes Rendus*, v. 223, Nov. 4, 1946, p. 726-727.

Formation of intergranular fissures has been observed in commercial aluminum (99.5%). The formation of such fissures is stimulated by the brittleness caused by the presence of impurities such as silicon, by the high rate of cooling and by internal stress in connection with the presence of gases dissolved in the liquid metal.

4-4. Action des Impuretés sur les Transformations Allotropiques du Cérium Metallique. (Influence of Impurities on the Allotropic Transformation of Metallic Cerium.) F. Trombe and M. Foex. *Comptes Rendus*, v. 223, Dec. 2, 1946, p. 949-950.

The transformations of cerium into the beta form were investigated. Upper limit of existence of the beta form was found to be above 250° C. Spontaneous transformation to this form has been observed in the ingots on a few months storage. Presence of calcium favors the transformation, while iron and aluminum inhibit it.

4-5. On the Exchange Interaction of the Valence and Inner Electrons in Ferromagnetic (Transition) Metals. S. Vonsovsky. *Journal of Physics (U.S.S.R.)*, v. 10, no. 5, 1946, p. 468-475. (In English.)

Approximate theory of the interaction of valence and inner electrons in ferromagnetic metals. 15 ref.

4-6. Sulphur in Cast Iron. H. Morrogh. *Engineering*, v. 162, Dec. 20, 1946, p. 598-600; Dec. 27, 1946, p. 621-623.

Work was undertaken to determine the extent to which nickel, molybdenum, copper, chromium, and aluminum, which form fairly stable sulphides, would combine with sulphur in cast iron. A large number of experimental melts were made. Resulting structures are shown in micrographs.

4-7. Stress-Induced Preferential Orientation of Pairs of Solute Atoms in Metallic Solid Solution. Clarence Zener. *Physical Review*, v. 71, Jan. 1, 1947, p. 34-38.

An analysis is given of one source of anelasticity which has heretofore been overlooked, the relaxation of the preferential orientation of pairs of solute atoms. Theory for dependence of anelastic effects upon temperature and upon crystallographic orientation. Theory illustrated by reference to previously reported alpha-brass internal friction observations.

For additional annotations indexed in other sections, see:

3-6-8-11-14; 7-29; 9-4; 11-2-4; 17-6; 1[illegible]; [illegible]32; 27-11.

5 POWDER METALLURGY

5-1. Copper-Base Powder Metallurgy Parts. Herbert Chase. *Materials & Methods*, v. 24, Dec. 1946, p. 1439-1444.

Parts made in the form of sintered copper-base compacts. Significance of their purity, electrical and electronic characteristics, resistance to corrosion, and malleability. Competitive considerations and a few notes on design.

5-2. Metal Powders. David B. Pall. *Interchemical Review*, v. 5, Autumn 1946, p. 59-68.

Various aspects of the manufacture and more recent applications of metal powders.

5-3. Powder Metallurgy Offers New Approach to Lower Costs. Joseph Bonnano. *Production Engineering & Management*, v. 18, Dec. 1946, p. 51-55.

Product improvement and reduced processing cost have resulted from an extensive use of powder metallurgy for mass producing small parts at the Lionel Corp.

5-4. The Uses of Powder Metallurgy in Automobile Engineering. Part I. Ferrous Powder Metallurgy. J. A. Judd. *Institution of Automobile Engineers Journal*, v. 15, Dec. 1946, p. 83-100.

Techniques outlined. Limitations and applications in Britain to bushings, valve guides, oil pump gears, electrical components and piston rings. Possible future developments.

5-5. The Uses of Powder Metallurgy in Automobile Engineering. Part II. Nonferrous Powder Metallurgy. W. H. Tait. *Institution of Automobile Engineers Journal*, v. 15, Dec. 1946, p. 101-110; appendix, p. 110-114.

Limitations and advantages of sintering and applications to bearings, bushings, thrust washers, filters, cylinder liners, clutch and brake friction plates, starter brushes, and for cutting tools. Applications to moldable compositions of mixtures of metal powders with thermosetting resins and future possibilities. Appendices give information concerning furnace atmospheres for sintering, sintering costs, specifications of porous bearings and bushings and of steel-backed lead-bronze bushings.

5-6. Powder Metallurgy. W. H. Tait. *Metal Industry*, v. 70, Jan. 10, 1947, p. 30-32.

Better presses and pressing techniques, more efficient controlled-atmosphere furnaces, and nonmetallic additions to influence the properties of the article, or to make the powder behave better in the press. (To be concluded.) (Presented before the Institution of Automobile Engineers.)

5-7. Large-Scale Production of Metal Hydrides. Herman W. Zabel. *Chemical Industries*, v. 60, Jan. 1947, p. 37-39.

Production, properties, and uses in chemical and metallurgical industries. Useful in preparation of powdered chromium alloys.

For additional annotations indexed in other sections, see:

3-12; 20-17; 24-10; 25-9.

(Turn to page 18)

Nickel powder is approximately 4 g. per cc., and although the particles are irregularly shaped they flow well as powder and also under pressure in a mold.

Major development of Charles Hardy, Inc., during 1946 has been the production of stainless steel powder (R-231), details of which will be given in a future issue of *Metals Review* devoted to ferrous alloys.

A new series of Gibsiloy electrical contacts is being made from silver-tungsten and silver-tungsten carbide by Gibson Electric Co. (R-232). Composition of the former ranges from 10 to 80% tungsten, and of the latter from 20 to 80% tungsten carbide; hardnesses are from Rockwell B-80 to B-100. High current capacity, nonwelding characteristics and long life are claimed.

Chrysler's Amplex Division (R-233) has made substantial progress in increasing the size and weight of Oilite machine parts produced from powder metals, as well as compounding many new alloy mixtures from more than 28 different elements. While parts were formerly limited, in general, to less than 8 sq.in. of area, Amplex Division now points to the quantity production of parts weighing over 100 lb. and as large as 20 in. in diameter. Largest cylindrical block made to date weighs 233 lb. and press capacity is now available for even larger pieces.

A production study of 19 parts manufactured in dies from metal powders disclosed the elimination of 145 machining operations of 20 types. A few of these parts are illustrated in the photograph.

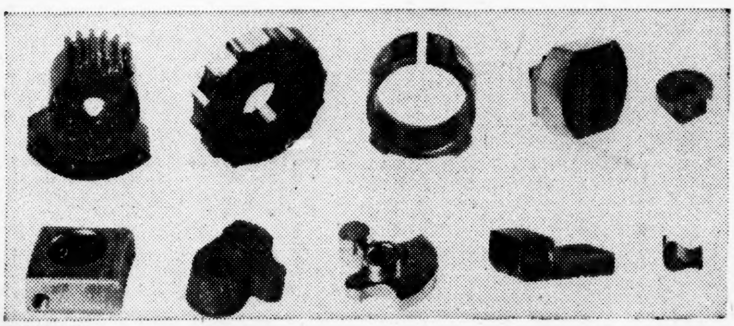
Powdered metallic friction materials for clutch or brake design have been described by General Metals Powder Co. (R-234). Basic ingredient of these friction facings is predominantly an electrolytically deposited copper powder. This powder is highly voluminous, a cubic inch weighing approximately 12 g., with density approximately 0.7.

Bound Brook Oil-Less Bearing Co. writes that new developments in lubricant-retaining bearings are under way but are not sufficiently advanced to warrant publication at the present time. A catalog giving specifications, applications, sizes and prices of these well-known products, however, is available (R-235).

An improved model of the Strauss hot press for all types of nonferrous powders is being furnished by National Diamond Hone and Wheel Co. (R-236). This press employs a resistance-heated carbon die which applies heat and pressure simultaneously.

The laboratory model weighs 150 lb. and measures 24x24x36 in. Resistance heating of the carbon die is accomplished by simply connecting the heating unit to a 115-volt alternating current circuit.

EDITOR'S NOTE—New nonferrous alloys and new uses of old alloys in welding, brazing and soldering have received considerable attention in the manufacturers' literature over the past twelve months. This field, however, will be more appropriately covered in the July 1947 issue of *Metals Review* which will feature welding and joining.



A Selection of Powder Metal Parts Made by Amplex

Addresses of Manufacturers

Ajax Engineering Corp.
Trenton, N. J. (R-199, R-200)

Ampco Metal, Inc. (R-219)
1745 S. 38th St., Milwaukee 4, Wis.

Amplex Division, Chrysler Corp.
P. O. Box 2718, (R-233)
Detroit 31, Mich.

Bellevue Industrial Furnace Co.
2971 Bellevue Ave., (R-201)
Detroit 7, Mich.

Bound Brook Oil-Less Bearing Co.
Bound Brook, N. J. (R-235)

Bridgeport Brass Co. (R-217)
Bridgeport 2, Conn.

Callite Tungsten Corp. (R-227)
540—39th St., Union City, N. J.

Cleveland Automatic Machine Co.
Ashland Rd., (R-203)
Cleveland, Ohio

Crucible Manufacturers Association
90 West St., (R-189)
New York 6, N. Y.

DCMT Sales Corp. (R-207)
315 Broadway, New York 7, N. Y.

Dee & Co., Thomas J. (R-220)
1900 West Kinzie St.,
Chicago 22, Ill.

Dempsey Industrial Furnace Corp.
Springfield 1, Mass. (R-198)

Detroit Electric Furnace Div. (R-195)
Kuhlman Electric Co.,
Bay City, Mich.

Division Lead Co. (R-215)
836 West Kinzie St., Chicago 22, Ill.

Dreisbach Engineering Corp. (R-212)
85 Warburton Ave.,
Yonkers 2, N. Y.

Eclipse Fuel Engineering Co. (R-190)
Rockford, Ill.

Fen Machine Co. (R-192)
1354 Babbitt Rd., Euclid, Ohio

Fisher Furnace Co. (R-193)
5535 North Wolcott Ave.,
Chicago 40, Ill.

Foundry Services, Inc. (R-213, R-214)
280 Madison Ave.,
New York 16, N. Y.

General Metals Powder Co. (R-234)
130 Elinor Ave., Akron 5, Ohio

Gibson Electric Co. (R-232)
8362 Frankstown Ave.,
Pittsburgh 21, Pa.

Hardy, Inc., Charles (R-231)
420 Lexington Ave.,
New York 17, N. Y.

Harvill Mfg. Co., H. L. (R-210)
Corona, Calif.

Hydraulic Press Mfg. Co. (R-204)
Mount Gilead, Ohio

Hydropress, Inc. (R-205)
570 Lexington Ave.,
New York, N. Y.

Indar Corp. (R-228)
910 East 23rd St.,
Indianapolis 5, Ind.

Intercontinental Engineers, Inc.
176 West Adams St., (R-197)
Chicago 3, Ill.

Johnson Gas Appliance Co. (R-194)
572 East Ave., N.W.,
Cedar Rapids, Iowa

Kindt-Collins Co. (R-196)
12651 Elmwood Ave.,
Cleveland 11, Ohio

Kux Machine Co. (R-209)
3924-44 W. Harrison St.,
Chicago 24, Ill.

Lester-Phoenix, Inc. (R-202)
2711 Church Ave.,
Cleveland 13, Ohio

Light Metal Machinery, Inc. (R-206)
736 Penton Building,
Cleveland 13, Ohio

Metal Hydrides, Inc.
(R-222, R-223, R-224, R-225)
12-24 Congress St., Beverly, Mass.

National Diamond Hone & Wheel Co.
180 Fulton St., (R-235)
New York 7, N. Y.

National Research Corp. (R-221)
100 Brookline Ave.,
Boston 15, Mass.

National Smelting Co. (R-216)
6700 Grant Ave., Cleveland, Ohio

Olds Alloys Co. (R-218)
8686 Rheem Ave., South Gate, Calif.

Plastic Metals (R-230)
Johnstown, Pa.

Radiant Combustion, Inc. (R-191)
Warren, Ohio

Reduction and Refining Co. (R-229)
96 Roanoke Ave., Newark 5, N. J.

Scovill Mfg. Co. (R-211)
Waterbury 91, Conn.

Westinghouse Electric Corp. (R-226)
306 Fourth Ave., Pittsburgh, Pa.

6 CORROSION

6-1 Acetic Acid Versus Materials of Chemical Plant Construction. Part II. *Chemical Engineering,* v. 53, Dec. 1946, p. 205-206, 208, 210, 212, 214, 216, 218, 220.

Final portion of a symposium in which typical materials of construction are evaluated for service involving acetic acid. Includes chemical porcelain; steel containing 24% Ni, 20% Cr and 3% Mo; Hastelloy; lead; high-silicon iron; chemical stoneware; rubber lining; nickel and nickel alloys.

6-2. Graphitic Corrosion of Cast Iron. Laurie M. Leedom. *Journal of the American Water Works Association,* v. 38, Dec. 1946, p. 1392-1397.

Mechanism of graphitic corrosion. Recommends use of alloyed metal for valves to minimize corrosion.

6-3. The Variation in Corrosion Properties Over Two Magnesium Alloy Sheets. E. R. W. Jones and Marion K. Petch. *Journal of the Institute of Metals,* v. 73, Nov. 1946, p. 129-137.

Details and results of sea-water spray corrosion tests on chromate-treated specimens selected at regular intervals from two large sheets of magnesium alloy, one to each of specifications D.T.D. 118 and D.T.D. 120A (AZM), to discover any variation in corrodibility from part to part of the sheet.

6-4. Corrosion of Copper, Lead, and Lead Alloy Specimens After Burial in a Number of Soils for Periods up to Ten Years. P. T. Gilbert. *Journal of the Institute of Metals,* v. 73, Nov. 1946, p 139-174.

Estimates of the amount of corrosion showed that the corrosiveness of the soils differed markedly. The most corrosive soil caused about 50 times as much loss in weight of specimens as the least corrosive soil, and caused complete penetration of one ½-in. bore pipe (4 lb. per yd.) in less than 5 years. It is considered that sulphate-reducing bacteria played an important part in the action taking place in the more corrosive soils. Difference in behavior of materials was less marked than differences between the soils. In the two most corrosive soils it would be unwise to bury unprotected pipes of any of the materials.

6-5. Attenuation of Forced Drainage Effects on Long Uniform Structures. Robert Pope. *Corrosion,* v. 2, Dec. 1946, p. 307-319.

Approximate equations have been developed which are useful in prediction of effects of forced drainage on cathodic protection of underground metallic structure. Soil and structure characteristics which enter into the equations. Charts show some of the relationships.

6-6. Cathodic Protection. C. H. McRaven. *Corrosion,* v. 2, Dec. 1946, p. 320-329.

How cathodic protection prevents corrosion. Effect of cathodic protection on other pipe lines in the vicinity and how to neutralize it.

6-7. Corrosion in High-Pressure Gas-Condensate Wells. H. Arthur Carlson. *Oil and Gas Journal,* v. 45, Dec. 21, 1946, p. 81-84.

Review of literature reveals lack of fundamental data on the effect of certain factors and indicates a definite need for correlation of data. Correlates and summarizes work that has been done so far to aid in planning future work. 10 ref.

6-8. Corrosion of Water Heaters. Part I. N. Booth, P. C. Davidge, G. H. Fuidge, and B. Pleasance. *Gas Journal,* v. 248, Dec. 11, 1946, p. 1047-1050, 1053.

The external corrosion of standard domestic heater burners and external surfaces upon which the gas flames impinge was investigated using various manufactured gases. The amount of corrosion was carefully determined and correlated with sulphur content of the gases. (To be continued.)

6-9. Uber den Angriff von Metallen in Feuchten Dämpfen der Halogenwasserstoffsauren. (Metal Corrosion in Moist Vapors of Hydrohalic Acids.) W. Feitknecht. *Helvetica Chimica Acta,* v. 29, no. 7, p. 1801-1915.

Corrosion of zinc, cadmium, nickel and iron by air containing HCl and HBr. Theoretical explanation of the very different rates of attack on different metals.

6-10. Experience Shows Amines Stop Corrosion. R. S. Moncrief and M. E. Dreyfus. *Power,* v. 91, Jan. 1947, p. 81-83.

After operating for 33 consecutive months at a capacity factor of 110% or 15,000,000 lb. of steam a day, results show that amine introduced into feed-water eliminates corrosion problems in boiler-feed pumps, deaerating trays and heaters.

6-11. Magnesium. R. R. Rogers, D. A. Tetu, and H. Livingstone. *Metal Industry,* v. 70, Jan. 3, 1947, p. 9-10.

Experimental results indicate that magnesium and its alloys offer good resistance to corrosion when exposed to inland, indoor and outdoor atmospheric conditions, but much less in marine atmospheres. It is pointed out that they should resist marine atmospheric conditions when properly protected with paint. (Paper presented to the Electrochemical Society.)

6-12. Some Aspects of the Corrosion of Aluminum. P. F. Thompson. *Journal of the Council for Scientific and Industrial Research (Australia) Reprint,* v. 19, no. 2, May 1946, 9 p.

Relation of corrosion to film formation. Film growth and breakdown were traced by electrochemical measurement. Visual evidence of evolution of hydrogen on abraded aluminum and magnesium in neutral liquids has been obtained. The importance of minute "chafing" or "fretting" movements on the stability of machines and structures. Continuous abrasion apparatus.

6-13. Oxidation Resistant Alloys. Benjamin Lustman. *Steel,* v. 120, Jan. 20, 1947, p. 68-69, 116-119.

Theory of oxidation of metals and alloys, including rate equations for the different types. The structure of scales formed on oxidation, and methods for determining oxidation resistance. Relevant facts concerning several alloys.

6-14. Ueber die Korrosion von Metallen in Sauren Dämpfen. (Corrosion of Metals in Acid Fumes.) W. Feitknecht. *Schweizer Chemiker-Zeitung,* v. 29, Oct. 1946, p. 332-333.

The corrosion of zinc, cadmium, nickel, and iron in HCl and HBr vapor was investigated. Chemical natures of the corrosion products formed at different vapor pressures (concentrations) determined.

6-15. Corrosion of Water Heaters. (Concluded.) N. Booth, P. C. Davidge, G. H. Fuidge, and B. Pleasance. *Gas Journal,* v. 248, Dec. 18, 1946, p. 1090-1094.

A discussion of the effects of time, thermal input, appliance design, and the presense of nitrogen oxides in the flue gas. Appendices contain methods for analysis of total sulphur content of gas and for analysis of deposits, and results of microscopic examination.

6-16. Corrosion Problems in High-Pressure Distillate Wells. Ralph H. Hock. *Oil Weekly,* v. 124, Jan. 27, 1947, p. 33-35.

Some methods followed by the Cotton Valley Field Operators Committee and others in detecting and controlling corrosion.

For additional annotations indexed in other sections, see:
4-1; 7-12; 19-37; 21-11; 27-16.

7 CLEANING & FINISHING

7-1. Some Facts About Aluminum Finishes. *Modern Metals,* v. 2, Dec. 1946, p. 10-12.

Function of a finish and type of finish for specific applications. Brief review of the various tests for finishes.

7-2. Car Finishes Improved by Direct-Fired Ovens. *Production Engineering & Management,* v. 18, Dec. 1946, p. 62-64.

Conveyerized direct-fired ovens at Dodge Division reduce salvage and accomplish better control of improved body finishes.

7-3. A New Chemical Coating to Protect Metals. *Chemical Industries,* v. 59, Dec. 1946, p. 1001.

Development and application of a unique polyvinylbutyral resin-phosphoric acid wash primer for reduction of atmospheric corrosion losses.

7-4. Steel Wire and Rope Manufacture. *Wire Industry,* v. 13, Dec. 1946, p. 677-678.

German methods of steel wiredrawing and rope manufacture of Felten and Guileaume at Köln-Mülham. Rod cleaning house in these mills consisted of three hydraulically operated swiveling cranes, each with six vats containing the usual sulphuric acid, water and lime wash solutions set around in a circular fashion. There was no system for agitating the acid baths; development of a substitute coating for lime or cleaning methods other than pickling had apparently received no attention.

7-5. Cleaning and Finishing Aluminum Products. Tom Winshurst. *Industrial Finishing,* v. 23, Dec. 1946, p. 32-34, 36, 38.

Reynolds Metals' setup for conveyerized spray painting followed by infrared baking as applied to a wide range of aluminum products finished in different colors.

7-6. Essentials to Good Spray Finishing. Frederick M. Crewdson. *Industrial Finishing,* v. 23, Dec. 1946, p. 40, 42, 44, 46, 48, 50.

Points to consider in the selection, use and cleaning of spray guns; some reasons for bad performance; necessity of clean air from the compressor; correct pressure of air; room cleanliness and good lighting.

7-7. Mechanized, Painting and Infrared Drying Setup. *Industrial Finishing,* v. 23, Dec. 1946, p. 70, 73, 74, 76.

Conveyerized setup includes a three-stage chemical cleaning, a mist coat followed by a full spray coat of white enamel, and finally a 6-min. drying in dual heat infrared oven which was custom built especially for job.

7-8. Machines and Auxiliary Equipment for Buffing and Polishing. John E. Hyler. *Steel,* v. 119, Dec. 30, 1946, p. 68-69, 112.

Standard buffers and polishers and special mechanisms for varying speed, etc. Dust collecting systems. (To be continued.)

7-9. Chromates in Metal Protective Paints. Hans Wagner. *Paint, Oil & Chemical Review,* v. 109, Dec. 12, 1946, p. 49-50.

Improvement of priming paints by use of small percentages of chromates was the subject of extensive German research. Numerous steel panels were painted, using various paint formulations, and given outdoor exposure tests. Results are outlined. (Abstract from *Farben Zeitung,* v. 47, 1942, p. 177, 179, 187-189.)

7-10. Ford Motor Co. Extends Use of Phosphate Coating Process for Passenger Cars. Part II. *Industrial Heating,* v.

(Turn to page 20)

Fifth Western Metal Congress and Exposition

Civic Auditoriums, Oakland, Calif., March 22 through March 27, 1947

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R. Cole, W. Scribner, E. G. Thomsen; representatives of Los Angeles Chapter A.S.M., San Diego Chapter, Portland Chapter, Puget Sound Chapter, and Spokane Chapter.

13, Dec. 1946, p. 2025, 2028, 2030, 2032, 2034.
Prime-coat painting operations, including the use of infrared heating for drying before and after painting.

7-11. Aluminum Films. *Chemical Engineering*, v. 53, Dec. 1946, p. 270.
Properties, appearance and thickness of aluminum films obtained by anodic oxidation of different aluminum alloys. (Digest of paper from *Rev. Metall.*, v. 42, 1945, p. 72-78; *Chimie et Industrie*, v. 56, v. 34, no. 1, p. 34.)

7-12. Finishes for Magnesium. R. T. Wood. *Light Metal Age*, v. 4, Dec. 1946, p. 14-17, 28.
Mechanism of corrosive attack on magnesium alloys and the reason why the subject of protective and decorative finishes has received so much attention. Chemical treatments and coatings commonly used in the United Kingdom, Germany, and the United States.

7-13. Recherche Rapide des Conditions de Polissage Electrolytique d'un Métal. (Rapid Determination of Conditions for Electrolytic Polishing of Metals.) F. Bertin. *Métaux et Corrosion*, v. 21, March 1946, p. 40-43.
Several methods for the determination of optimum conditions for electrolytic polishing of different metals.

7-14. Rusting and Painting Trouble Corrected. F. A. Westbrook. *Industrial Finishing*, v. 23, Dec. 1946, p. 82, 84.
Solution of problem in connection with the finishing of 8-in. pressed steel shells for commercial product filters. Trouble arose when the company was relying upon four outside concerns to manufacture steel shells for its filters.

7-15. Metal Polishes. Milton A. Lesser. *Soap and Sanitary Chemicals*, v. 22, Dec. 1946, p. 147, 149, 151, 153.
Compounding formulas and directions for 26 different preparations, together with instructions concerning their use and applicability. 26 ref.

7-16. Discussion of Porcelain Enamel Defects. A. I. Andrews. *Finish*, v. 4, Jan. 1947, p. 26, 56.
Metal defects; process and design defects; process and enamel defects.

7-17. A Completely Conveyerized Plant for Stove Work and Jobbing. Gerald E. Stedman. *Finish*, v. 4, Jan. 1947, p. 15-18, 32, 33, 62.
Plant and equipment at Brown Stove Works.

7-18. Metallizing Glass and Ceramic Materials. A. J. Monack. *Glass Industry*, v. 28, Jan. 1947, p. 21-25, 40, 42-44.
Purposes and fundamentals of metallizing; mechanical films; metallic paints; metal spraying; cathode sputtering and metal evaporating; chemical reduction films; electroplating; theoretical aspects.

7-19. Principles of Immersion and Humidity Testing of Metal Protective Paints. A. C. Elm. *ASTM Bulletin*, Oct. 1946, p. 9-27.
Round-table discussion on problems encountered in testing for the humidity and immersion resistance of paints on steel. Reproducibility of tide range exposures; effects of nonuniform surface preparation; surface conditions wanted on steel panels; surface cleaning procedures.

7-20. Aluminum Cleaning Must Be Engineered. Don Vance. *Automotive and Aviation Industries*, v. 96, Jan. 1, 1947, p. 22, 82.
Removal of soils imbedded during the process of manufacture, such as from drop hammers, rollers and heat treating, and others caused by grease and oils, paints and dyes.

7-21. Conveyerizing Finishing Processes. Part I. John E. Hyler. *Organic Finishing*, v. 7, Dec. 1946, p. 15-21.
Layout of conveyer systems used in finishing operations. (To be continued.)

7-22. Finishing Aluminum. Part II. Rich Mansell. *Organic Finishing*, v. 7, Dec. 1946, p. 23-29.
Anodizing, the Alumilite process, chromating and phosphating. (To be continued.)

7-23. Using Abrasive Belts for Buffing and Polishing. John E. Hyler. *Steel*, v. 120, Jan. 13, 1947, p. 84-85, 109.
Some applications and advantages of abrasive belts. (To be concluded.)

7-24. Correct Maintenance and Use of Manual Spray Equipment. Frank V. Faulhaber. *Products Finishing*, v. 11, Jan. 1947, p. 24-26, 28, 30, 32, 34.
Spray guns; their use with various materials; proper methods of cleaning them.

7-25. Preparing Iron and Steel for Bright Zinc Plating. Arthur P. Schulze. *Products Finishing*, v. 11, Jan. 1947, p. 46-48, 50, 52, 54, 56, 58.
Four techniques are: still or soak tank, using either an alkaline material or an emulsifying solvent, either separately or in combination as a two-bath process; electrocleaning tank, employing direct or reverse current; automatic mechanical washing machine of the fixed spray, revolving wash arm, rotary drum and splashing or cascade types, using alkaline degreasing materials; combination of one of these methods with another, depending upon individual plant conditions.

7-26. Barrel Finishing of Metal Products. Part V. H. Leroy Beaver. *Products Finishing*, v. 11, Jan. 1947, p. 62-64, 66, 68, 70, 72.
Development of the tubbing machine.

7-27. Electropolishing. C. L. Faust. *Metal Industry*, v. 69, Dec. 20, 1946, p. 512-513.
Status of electropolishing as a metal finishing process.

7-28. Effect of Lead in Hot Dip Galvanizing Baths. W. G. Imhoff. *Iron Age*, v. 159, Jan. 9, 1947, p. 46-49.
Varied effects of lead in hot dip galvanizing baths. An adequate lead content produces many beneficial effects, such as giving a thin, fluid bath and smoother and more lustrous coatings. Sources of lead in spelter; cites several instances in which lead additions served to correct some galvanizing difficulties.

7-29. Structure of Aluminum Anodic Films, Formed in Oxygen Gas Discharge. P. D. Dankov and D. V. Ignatiev. *Reports of Academy of Sciences of U.S.S.R.*, v. 54, no. 3, 1946, p. 235-238. (In Russian.)
During investigation of the structure of anodized aluminum surfaces, difficulty was encountered in determination of results of the primary process of oxidation because of the secondary reaction of oxide with different constitutents of the bath. To avoid this difficulty, a very thin layer of aluminum condensed from aluminum vapors on mica plate in vacuum and then detached was anodized.

7-30. Anodic Oxidation. J. Hérenguel and R. Segond. *Metal Industry*, v. 70, Jan. 3, 1947, p. 3-5.
A method of constructing three-dimensional curves of current density-temperature-film thickness to derive the limiting conditions of bath operation to obtain successful anodic films on pure aluminum and its alloys. (Paper presented to the Société Francaise de Métallurgie.)

7-31. Tinning Cast Iron. *Iron Age*, v. 159, Jan. 16, 1947, p. 44-45.
Procedures for tinning cast iron by use of the new fused salt baths. Process is said to result in better adhesion than the older methods and to give smoother and more continuous coatings.

7-32. Technical Developments of 1946. Richard A. Mozer. *Metal Finishing*, v. 45, Jan. 1946, p. 50-55, 95-99.
General review covering theory; anodizing; corrosion prevention; polishing; cleaning; abrasive blasting; pickling; coatings; electroforming and metallizing nonconductors; metal coloring; testing; and miscellaneous. 210 ref.

7-33. Color Control for Aluminum Dyeing. E. Rhael and F. P. Summers. *Metal Finishing*, v. 45, Jan. 1947, p. 64-65.
Use of organic dyestuffs for coloring anodized aluminums. Plant procedures and control techniques.

7-34. Buffing and Polishing. John E. Hyler. *Steel*, v. 120, Jan. 20, 1947, p. 84, 87-88.
Some of the more dependable techniques now being employed in high speed production.

7-35. Firing Ground Coat and Cover Coat Ware Together. J. T. Irwin. *Enamelist*, v. 24, Jan. 1947, p. 4-7.
Soft ground coats can be used on all production items handled in Clyde Porcelain Steel Corp., and there are definite advantages in flexibility of production, greater production, lower fuel costs and less warpage, when using such ground coats. (Presented at the Eighth Annual Forum of the Porcelain Enamel Institute, Inc., Oct. 1946.)

7-36. Can We Porcelain Enamel Stainless Steel? W. J. Plankenhorn. *Enamelist*, v. 24, Jan. 1947, p. 8-11.
Typical analyses of several types of stainless steel as compared to commercial enameling iron. Cites some recent experiments and lists advantages gained where stainless steel is used for porcelain enameling to replace regular enameling iron.

7-37. Rubber Linings Protect Steel Against Corrosion and Abrasion. O. S. True. *Product Engineering*, v. 18, Jan. 1947, p. 142-148.
Properties of rubber in protecting cast iron and steel surfaces from the corrosive attack of gaseous and liquid chemicals, including preparation of metal surfaces and design considerations that facilitate applying rubber linings and coatings to tanks, pipe, fittings, fans and pump impellers.

7-38. Time and Costs Cut by New Diamond Polishing Compound. *Production Engineering & Management*, v. 19, Jan. 1947, p. 108.
A number of features in which it excels, and applications in the field of precision manufacture.

7-39. A Method for Improving the Adhesion of Sprayed Metal to Blasted Surfaces. *Metco News*, v. 3, Jan. 1947, p. 12-14.
Use of a low-carbon steel undercoat makes it possible to use finer abrasives, giving lower blasting costs for any given bond strength. Comparative test results presented.

7-40. Finishing Toy Trains. Floyd McKnight and Joseph G. Cowley. *Organic Finishing*, v. 8, Jan. 1947, p. 15-22.
Precleaning treatment; equipment and operations involved in actual cleaning and metal preparation at Lionel Corp. (To be continued.)

7-41. Finishing Aluminum. (Concluded.) Rick Mansell. *Organic Finishing*, v. 8, Jan. 1947, p. 22-28, 46.
Organic coatings; chemical finishes; mechanical finishes.

7-42. Conveyerizing Finishing Processes. Part II. John E. Hyler. *Organic Finishing*, v. 8, Jan. 1947, p. 37-43.
Equipment for conveyerized dipping operations and for automatically spraying various types of work.

7-43. Ceramic Coatings for Steel in High-Temperature Service. William N. Harrison, Dwight G. Moore, and Joseph C. Richmond. *Better Enameling*, v. 18, Jan. 1947, p. 6-10.
Extracts from report by National Bureau of Standards on development and testing of special heat resistant ceramic coatings for low-carbon steels and supplementary information on service tests, compositions and the use of the coatings in production of parts for the armed services.

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Technical Program, Western Metal Congress

Sessions at Civic Auditoriums, Oakland, Calif.

Monday Morning, Mar. 24

9:00-9:55—Principles of Heat Treatment of Steels (Lecture No. 1), E. E. Thum, Editor, *Metal Progress*.

10:00-10:55—Electron Microscopy, David Harker, General Electric Co.

10:00-10:55—Toolsteels (Specific Discussion), Norman Stotz, Braeburn Alloy Steel Corp.

11:00-11:55—Interpretation of Creep and Stress-Rupture Data (Lecture No. 1), F. B. Foley, Midvale Co.

11:00-11:55—Physical Chemistry of Steelmaking (Lecture No. 1), John Chipman, Massachusetts Institute of Technology.

Monday Afternoon

2:00-2:55—Physical Metallurgy of Stainless Steels (Lecture No. 1), V. N. Krivobok, International Nickel Co.

2:00-2:55—Effect of Residual Stresses on the Fatigue Strength of Metals (Lecture No. 1), John O. Almen, General Motors Corp.

3:00-3:55—Physical Metallurgy of Aluminum Alloys (Lecture No. 1), E. H. Dix, Jr., Aluminum Co. of America.

3:00-3:55—Theory of Corrosion, R. M. Burns, Bell Telephone Laboratories.

4:00-4:55—Industrial Growth of the West, F. T. Letchfield, Wells Fargo Bank & Union Trust Co.

Monday Evening

Golden Gate Lecture

8:00-8:55—Correlation of Recent Data on Hardenability, A. L. Boegehold, President of American Society for Metals, and Head, Metallurgical Department, Research Laboratories Division, General Motors Corp.

Tuesday Morning, Mar. 25

9:00-9:55—Principles of Heat Treatment of Steels (Lecture No. 2), E. E. Thum.

10:00-10:55—Fabrication of the Brasses, Harry P. Croft, Chase Brass & Copper Co.

10:00-10:55—Toolsteels (General Discussion). William H. Wills, Allegheny Ludlum Steel Corp.

11:00-11:55—Interpretation of Creep and Stress Rupture Data (Lecture No. 2), Francis B. Foley.

11:00-11:55—Physical Chemistry of Steelmaking (Lecture No. 2), John Chipman.

Tuesday Afternoon

2:00-2:55—Physical Metallurgy of Stainless Steels (Lecture No. 2), V. N. Krivobok.

2:00-2:55—Effect of Residual Stresses on the Fatigue Strength of Metals (Lecture No. 2), John O. Almen.

3:00-3:55—Physical Metallurgy of Aluminum Alloys (Lecture No. 2), E. H. Dix, Jr.

3:00-3:55—Preparation of Surfaces for Protective Coatings, James R. Ewing, Solventol Chemical Products, Inc.

4:00-4:55—Nondestructive Testing by Means of the Supersonic Reflectoscope, Floyd Firestone, Consulting Physicist.

4:00-4:55—New Approaches in Heat Treatment, Glen Riegel, Caterpillar Tractor Co.

Wednesday Morning, Mar. 26

9:00-9:55—Hardenability of Steels, W. E. Jominy, Chrysler Corp.

10:00-10:55—Tool Materials and Their Application, A. H. d'Arcambal, Pratt & Whitney Division.

10:00-10:55—Controlled Atmospheres, H. M. Heyn, Surface Combustion Co.

11:00-11:55—Alloys for Ultra High-Temperature Service, F. S. Badger, Haynes Stellite Co.

11:00-11:55—Steel Melting Practice, C. H. Herty, Jr., Bethlehem Steel Co.

Wednesday Afternoon

2:00-2:55—High Chromium Irons, H. D. Newell, Babcock & Wilcox Tube Co.

2:00-2:55—Plasticity of Metals, John H. Hollomon, General Electric Co.

3:00-3:55—Physical Metallurgy of Aluminum Alloys (Lecture No. 3), E. H. Dix, Jr.

3:00-3:55—Protective Coatings, R. M. Burns, Bell Telephone Laboratories.

4:00-4:55—X-Ray Diffraction, Kent R. Van Horn, Aluminum Co. of America.

Thursday Morning, Mar. 27

9:00-9:55—Research in Carbon Steels, Harold K. Work, Jones & Laughlin Steel Corp.

10:00-10:55—The Heat Treatment of Precision Cutting Tools, A. H. d'Arcambal, Pratt & Whitney Division.

11:00-11:55—Alloys for Low-Temperature Service, S. L. Hoyt, Battelle Memorial Institute.

Thursday Afternoon

2:00-2:55—Stainless Steels in Aircraft, Given Brewer, Consulting Metallurgist.

2:00-2:55—Fracture of Metals, John H. Hollomon, General Electric Co.

3:00-3:55—Recent Developments in Magnesium Alloys, J. C. McDonald, Dow Chemical Co.

3:00-3:55—Recent Advances in Powder Metallurgy, Earl R. Parker, University of California.

4:00-4:55—Mechanical Testing, Arthur E. Focke, Diamond Chain & Mfg. Co.

4:00-4:55—Electron Microscope, Charles Banca, Radio Corp. of America.

American Welding Society Program

All Sessions at Civic Auditoriums, Oakland, Calif.

Monday Morning, Mar. 24

Three Consecutive Sessions

Chairman—Mark Haines, San Francisco Chapter, A.W.S.

Vice-Chairman—T. S. Sholes, Spokane Chapter, A.W.S.

9:00-9:55—Hard Facing—a Major Factor in Manufacture and Maintenance, H. W. Sharp, Stoody Corp.

10:00-10:55—Welding Stainless and Heat Resisting Alloys, T. R. Lichtenwalter, Republic Steel Corp.

11:00-11:55—Oxy-Acetylene Pressure Welding, E. R. Proctor, Menasco Mfg. Co.

Edgar W. Bartz, Chairman, A.W.S. Speakers Program Committee

Monday Noon

A.W.S. Official Convention Luncheon
25th Anniversary
of San Francisco Chapter

Master of Ceremonies—Charles Smith, Linde Air Products Co.

Welcoming Remarks, Carl J. Eastman, President, San Francisco Chamber of Commerce.

Welcoming Remarks, James H. L'Hommedieu, President, Oakland Chamber of Commerce.

The Future of Welding in the West, Lee Delhi, National A.W.S. President.

Presentation of Lincoln Gold Medal Award to H. E. Kennedy.

(Turn to page 23)

7-44. On the Mechanism of Metal Cleaning. Samuel Spring and Louise F. Peale. *Metal Progress,* v. 51, Jan. 1947, p. 102-106.

Direct visual and photographic observations were made of the process of oil removal from metal.

For additional annotations indexed in other sections, see:

11-5-6-7; 19-28; 23-21; 24-23; 26-9; 27-22-25-29-30.

8 ELECTROPLATING

8-1. Bright Nickel Plating. A. F. Brockington. *Metal Industry,* v. 69, Dec. 6, 1946, p. 468-470.

Advantages and disadvantages of solutions of the Watts type for obtaining a bright nickel deposit that does not require mopping. Particulars of the structure of deposits, types of solution, brightening agents, alloy deposits of cobalt-nickel, and typical bright plating equipment are given. (To be concluded.)

8-2. The Control of pH in Nickel Plating Solutions. H. Bandes. *Electrochemical Society Preprint* 90-34, 1946, 14 p.

Equations for computing the amount of acid or base necessary to lower or raise the pH of a nickel plating solution a given amount. Equations were derived from experimental potentiometric titration data. Procedure for carrying out the titrations and significance of the results to the nickel plating process.

8-3. AC Die Casting and Plating Operations. Joseph Geschelin. *Automotive and Aviation Industries,* v. 95, Dec. 15, 1946, p. 30-31, 100.

Manufacture of two zinc die-cast instrument panels and a long single bar radiator grille section at AC Spark Plug Division. Sequence of operations through the plating department.

8-4. Cadmium Plate and Passivated Cadmium-Plate Coatings. Frank Taylor. *Metallurgia,* v. 35, Nov. 1946, p. 28-31.

Dealing with the passivation of zinc and cadmium surfaces, Mr. Taylor comments on Mr. Halls' article published in October 1946. Hints at government research which could give correct picture of relative advantages. Passivating a surface gives outstanding advantages.

8-5. Principles of Electrodeposition. *Electrotypers & Stereotypers Journal,* v. 10, March 1946, p. 162-163; April 1946, p. 188-189; May 1946, p. 216-217; June 1946, p. 228-229; July 1946, p. 12-13; Aug. 1946, p. 28-29; Oct. 1946, p. 68-69.

Nickel plating of stereotype plates is described in considerable detail in this series. Includes theory as well as practice. (To be continued.)

8-6. Electroforming for Precision. H. R. Clauser. *Scientific American,* v. 176, Jan. 1947, p. 15-17.

Three matrix techniques; metals formed by the process; advantages; a few examples of applications.

8-7. Bright Nickel Plating. (Concluded.) A. F. Brockington. *Metal Industry,* v. 69, Dec. 20, 1946, p. 513-514.

Effect of various contaminants upon the solution and the methods that have been devised for their removal. Fully automatic bright nickel and chromium plating plant.

8-8. Longer Life for Piston Rings Predicted With Chrome Plating. *S.A.E. Journal,* v. 55, Jan. 1947, p. 69-70.

Tests show chromium plating the piston-ring periphery will increase ring life and decrease ring troubles. Installation of a chromium-plated compression ring in the top groove nearly doubles the life of the rest of the rings. If all the rings are plated, their durability is quadrupled. (Digest of paper "Development of Chrome Plated Piston Rings for Aircraft Engines" by J. B. Minnich, presented at the S.A.E. National Meeting, Oct. 4, 1946.)

8-9. Plating With Platinum, Palladium and Rhodium. H. M. Haberman. *Metal Finishing,* v. 45, Jan. 1946, p. 56-58.

Various plating bath compositions and method of preparation.

8-10. The Hull Cell. H. J. Sedusky and J. B. Mohler. *Metal Finishing,* v. 45, Jan. 1947, p. 59-63.

Various examples of use of the Hull test which covers the entire plating range of current densities in one operation.

8-11. Electroforming. E. A. Ollard. *Metal Industry,* v. 70, Jan. 3, 1947, p. 6-8.

Reproduction of articles by electroforming; materials, types of mold, conducting surfaces, connections, coverings, types of metal and solution formulas. (To be continued.)

8-12. Control Apparatus for the Production of Uniform Electrodeposits From a Rectified A. C. Supply. D. Ashby and S. Wernick. *Monthly Review,* v. 34, Jan. 1947, p. 42-49.

Some of the control equipment used in British industry.

For additional annotations indexed in other sections, see:

7-25; 27-25.

9 PHYSICAL TESTING

9-1. Some Unusual Tests of Cast Iron. Part I. James S. Vanick. *Foundry,* v. 75, Jan. 1947, p. 66-71.

A number of nonstandard methods used to obtain special information. Test pieces and equipment illustrated. This installment covers bending tests; compression tests; tensile testing; elasticity and deformation testing; tortion testing. (To be concluded.)

9-2. Influence of the Duration of Test on the Strength Value of Materials. T. A. Kontorova. *Reports of the Academy of Sciences of U.S.S.R.,* v. 54, no. 1, 1946, p. 23-26. (In Russian.)

Dependence of strength of material on the duration of the test is a form of fatigue. Use of an altered Maxwell equation for the determination of this dependence proposed.

9-3. The Effects of Notching Under Axial and Eccentric Loads. Georges Welter. *Metallurgia,* v. 35, Nov. 1946, p. 33-36.

Results of tests made on construction materials in order to establish a classification with respect to ductility of light metals and alloys in comparison with other heavy structural materials. Standard and special notched specimens were tested under axial and eccentric loads producing single tension as well as combined tension and bending stresses.

9-4. Plastic Flow, Creep, and Stress Relaxation. Charles Mack. *Journal of Applied Physics,* v. 17, Dec. 1946, p. 1086-1107.

A theoretical treatment in three parts. In Part I, it is shown that product of strain rate and viscosity is equal to the sum of the differences between applied stress and yield values. This relationship is applied to plastic flow. Equations are given for coefficient of viscosity of such systems and for relaxation of stress at constant deformation as a function of time. In Part II, the general equation in Part I is applied to creep. Equations are derived which give stress as a function of strain rate and strain, and as a function of strain rate, strain, and time. In Part III, equations given in connection with plastic flow, creep due to workhardening, thixotropy, and creep in combination with elastic aftereffect are applied to literature data. These equations describe the deformation and relaxation mechanisms of a wide variety of materials. 40 ref.

9-5. New Design of Elastic Proving Bar. C. G. Lutts and Dante Cuozzo. *ASTM Bulletin,* Oct. 1946, p. 41-42.

New design of elastic proving bar whereby elongation is measured centrally along the axis, thus automatically giving average elongation with a single reading. Preliminary calibration data to a load of 200,000 psi.

9-6. Correlated Brittle Fracture Studies of Notched Bars and Simple Structures. C. W. MacGregor, N. Grossman, and P. R. Shepler. *Welding Journal,* v. 26, Jan. 1947, p. 50s-56s.

A preliminary step in correlating the action of notched bars and various types of structures to obtain data of direct use to designers. A thin circular disk, freely supported along its circumference and bent by a centrally applied load was studied. A notched bar in simple bending was found to have identical transition temperatures at the same deflection velocities as the circular disk. The same approach is believed applicable to the study of brittle temperature characteristics of more complicated structures. 12 ref.

For additional annotations indexed in other sections, see:

3-9-10; 11-3; 18-17; 19-20-29; 21-7; 22-31; 24-3-5-21-24-30-31; 27-3.

10 ANALYSIS

10-1. Modified Colorimetric Determination of Chromium in Ferrous Materials. Eugene H. Baker. *Foundry,* v. 75, Jan. 1947, p. 92, 182.

Modified Garratt and Mellan procedure. Metal is dissolved in a high-oxidizing acid and re-oxidized with a powerful oxidizing salt in aqueous solution. Filtrate is obtained and quickly measured, color reagent added, pH adjustment made, and measurement made using an electrophotometer or similar apparatus.

10-2. Rapid, Accurate, Economic Analysis of Iron and Steel by Means of the Spectrograph. Roy F. Lab. *Blast Furnace and Steel Plant,* v. 34, Dec. 1946, p. 1509-1514.

Equipment used at Copperweld Steel Co.; procedure in making an analysis; use of the spectrograph.

10-3. Operating Characteristics of the Sargent Model XX Visible Recording Polarograph. James J. Lingane. *Industrial and Engineering Chemistry (Analytical Edition),* v. 18, Dec. 1946, p. 734-738.

General characteristics of the Sargent-Heyrovsky visible recording polarograph. Performance of the instrument compared to that of other commercially available recording polarographs.

10-4. Crystallographic Techniques in Chemical Analysis. J. B. Nelson. *British Coal Utilisation Research Association Monthly Bulletin,* v. 10, Sept. 1946, p. 257-280.

Four different techniques; how they can be coordinated for best results in the study of difficult physico-chemical problems. 159 ref.

10-5. Electrographic Methods of Analysis. Eric A. Arnold. *Electrochemical Society Preprint* 90-37, 1946, 4 p.

In this technique, the specimen to be tested is made an anode in an electric circuit against an inert cath-

(Turn to page 24)

American Welding Society Program

(Continued from page 21)

Tuesday Morning, Mar. 25

Three Consecutive Sessions on Resistance Welding

Chairman—Mark Cassimus, Sullivan-Cassimus Co., San Francisco.

Vice-Chairman—T. E. Piper, Northrup Aircraft, Inc.

9:00-9:55—The Future of Resistance Welding, M. S. Clark, Federal Welding Co.

10:00-10:55—Resistance Welding Applications, J. H. Cooper, Taylor-Winfield Corp.

11:00-11:55—Possibilities of Electronic Control, G. W. Garmon, General Electric Co.

Tuesday Afternoon

Two Consecutive Sessions

Chairman—Elmer Gunette, Tacoma Section, A.W.S.

Vice-Chairman—Ray Gann, Rheem Mfg. Co.

2:00-2:55—Electrode Alloys for Resistance Welders, G. N. Sieger, S.M.S. Corp.

3:00-3:55—Inert Gas Shielded Arc Welding, T. E. Piper, Northrup Aircraft, Inc.

(Continued in Column 3)

Important!

Hotel Reservations

Sixteen hotels in Oakland and 12 hotels just across the bay in San Francisco are cooperating in the Western Metal Congress and Exposition by pooling all available hotel rooms in a central housing bureau. Fast, frequent and direct transportation across the Oakland-San Francisco Bridge is provided by the Key System. Electric trains will stop directly in front of the Oakland Civic Auditoriums.

Hotel reservations should be made by writing direct to the Housing Bureau at the address below, specifying whether a hotel in Oakland or San Francisco is preferred. Give date of arrival and date of departure, and enclose a deposit of $5.00 per room. Write to:

Housing Bureau
Howard S. Sipe, Manager
Convention and Tourist Dept.
417 Fourteenth St.
Oakland 12, Calif.

Wednesday Morning, Mar. 26

Chairman—David Bisbee, Los Angeles Section, A.W.S.

Vice-Chairman—Chas. Smith, Linde Air Products Co.

9:00-9:55—Submerged Arc Welding in Light Gage Metals, H. E. Kennedy, Albany, Calif.

10:00-10:55—Thermit Welding of Rails and Large Castings, J. B. Tinnon, Metal & Thermit Corp.

11:00-11:55—Welding and Fabricating of Heavy Alloys for High-Temperature and Corrosion Applications, Charles G. Chisholm, Haynes Stellite Co.

Wednesday Afternoon

Chairman—Paul Kullberg, Portland Section, A.W.S.

Vice-Chairman—G. S. Schaller, Puget Sound Section, A.W.S.

2:00-2:55—Modernized Fabrication, Earl Griffeth, Wooldridge Mfg. Co.

3:00-3:55—The Coordinated Developments in A.C. Welders and Electrodes, C. P. Croco, Westinghouse Electric Corp.

Thursday Morning, Mar. 27

Chairman—L. P. Henderson, Lincoln Electric Co.

Vice-Chairman—Walter Danton, San Francisco Naval Dry Docks.

9:00-9:55—Modern Design in Structural Welding, LaMotte Grover, Air Reduction Sales Co.

10:00-10:55—Low Temperature Brazing, Herman Folgner, Handy & Harman.

American Foundrymen's Association Program

Monday Noon, March 24

Luncheon, Hotel Leamington, Oakland

Chairman—Richard Vosbrink, President, Northern Calif. Chapter, A.F.A.

The Future for Industry in the West, Don Follet, Oakland Chamber of Commerce.

Monday Afternoon

Chairman—Leon Cameto, Production Foundry Co.

Co-Chairman—James Lynch, Jr., Lynch Brass and Aluminum Foundry.

2:00-3:25—Aluminum Castings, Roy Paine, Aluminum Co. of America.

Chairman—Fred A. Mainzer, Pacific Brass Foundry.

Co-Chairman—Herbert E. Eggerts, Berkeley Brass Foundry.

3:30-5:00—Brass and Bronze Castings, George Dreher, National Director, A.F.A.

Tuesday Afternoon, Mar. 25

Chairman—Harry Bossi, Macaulay Foundry.

Co-Chairman—Hugh Prior, Enterprise Engineering & Foundry.

2:00-3:25—Core Blowing, L. D. Pridmore, Int'l. Molding Machine Co.

Richard Vosbrink of Berkeley Pattern Works, President of the Northern California Chapter, A.F.A., Is Chairman of the Program Committee for the Western Metal Congress

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Chairman—Norman E. Schlegel, Vulcan Foundry Co.

Co-Chairman—George Stewart, Pacific Brass Foundry Co.

3:00-5:00—Foundry Sands, Sand Committee of Northern California Chapter, A.F.A. (Harold E. Henderson—Iron; James L. Francis—Steel; George Stewart—Nonferrous.)

Wednesday Afternoon, Mar. 26

Chairman—Ray A. Wilson, Pacific Steel Castings Co.

Co-Chairman—John A. Watson, General Metals Corp.

2:00-3:25—Steel Castings, Speaker to be announced.

Chairman—Robert Gregg, Reliance Regulator Co.

Co-Chairman—A. M. Ondreyco, Vulcan Foundry Co.

3:30-5:00—Iron—Cupola Melting, J. T. MacKenzie, American Cast Iron Pipe Co.

Thursday Afternoon, Mar. 27

Chairman—Ed. M. Welch, American Manganese Steel Co.

Co-Chairman—Charles Hoehn, Jr., Enterprise Engine & Foundry.

2:00-3:25—Safety Code for Foundries, Speaker to be announced.

Chairman—R. A. Johnson, General Metals Corp.

3:00-5:00—Standards, Inspection, and Repair of Aircraft Quality Castings, T. E. Piper, Northrup Aircraft, Inc.

ode, such as platinum, the electrolyte and necessary reagents being soaked into a piece of bibulous paper in intimate contact with both the anode and cathode. During flow of the current, the metals of the anode enter the paper and react with suitable reagents to form insoluble compounds.

10-6. Spectrochemische Analyse van Metaallegeringen Met Behulp van Emissiespectra. (Spectrochemical Analysis of Alloys by Means of Emission Spectra.) R. Schmidt. *Metalen,* v. 1, Nov. 1946, p. 37-44.

Quantitative spectrochemical analysis by means of direct reading and photographic instruments with relative merits of each procedure. Survey of problems awaiting solution.

10-7. Extraction of Vanadium From Aqueous Acid Solutions by Isopropyl Ether. James J. Lingane and Louis Meites, Jr. *Journal of the American Chemical Society,* v. 68, Jan. 4, 1947, p. 2443-2447.

Optimum conditions for quantitative separation of ferric iron from vanadium by an isopropyl ether extraction.

10-8. Polarographic Investigation of Oxalate, Citrate and Tartrate Complexes of Ferric and Ferrous Iron. James J. Lingane. *Journal of the American Chemical Society,* v. 68, Jan. 4, 1947, p. 2448-2453.

A photographically recording polarograph which has several advantages over commercially available instruments. The polarographic characteristics of ferric and ferrous iron in citrate, tartrate, and oxalate solutions were investigated, since these agents appeared to be most promising for determination of iron.

10-9. A Method for the Spectrochemical Determination of Germanium, Tin, and Lead in Ore Samples. Graham W. Marks and H. Tracy Hall. *Bureau of Mines Report of Investigations* 3965, Nov. 1946, 38 p.

After further research and development, the total-energy method of spectrochemical analysis will be quite suitable for the general analysis of ore samples. Effects of various extraneous materials, particularly oxides, which enter into the formation of complex silicates, upon the intensities of characteristic lines.

10-10. The Polarographic Estimation of Antimony in Cable Sheathing Alloy B (B.S. 801). H. F. Hourigan. *Analyst,* v. 71, Nov. 1946, p. 524-527.

The lead alloy is hardened by use of 0.8 to 0.9% antimony. These limits are critical, hence composition must be carefully controlled. A polarographic method has been worked out.

10-11. Magnesium in Aluminum. *Metal Industry,* v. 69, Dec. 20, 1946, p. 511.

Rapid analytical methods developed in Germany.

10-12. Nouvelle Methode de Determination de l'Oxygene dans le Fer et l'Acier. (A New Method for Oxygen Determination in Iron and Steel.) N. Vigna. *Helvetica Chimica Acta,* v. 29, no. 7, p. 1667-1669.

New method based on principle commonly used for determination of carbon in steel has accuracy of ±0.01%.

10-13. Alloy Steel Analysis. Quantitative Determination of Heavy Metal Oxinates. W. G. Cass. *Chemical Age,* v. 55, Dec. 7, 1946, p. 709-712.

Reviews the various procedures described in the literature.

10-14. Analysis of Gold and Gold Alloy Solutions. Edward A. Parker. *Monthly Review,* v. 34, Jan. 1947, p. 33-40.

Method as finally modified includes elimination of cyanides with hydrochloric and nitric acids; removal of excess nitrites with hypochlorite; neutralization to litmus endpoint with bicarbonate; addition of potassium iodide; and titration of the liberated iodine with arsenious oxide. The gold content of the sample size is of the order of 10 to 80 mg. Details of the final, approved procedure and the tests made.

10-15. Spectrographic Analysis. G. Stanley Smith. *Metal Industry,* v. 70, Jan. 10, 1947, p. 23-24.

Two or three of the circuits which have come or are coming into favor in Russia.

10-16. Recent Developments in Industrial Emission and Absorption Spectroscopy. *Journal of Scientific Instruments,* v. 23, Dec. 1946, p. 292-301.

Proceedings of Conference on Industrial Spectroscopy, London, 1946. 31 ref.

10-17. Magnetic Rotation of the Direct Current Arc in Spectrographic Analysis. A. T. Myers and B. C. Brunstetter. *Analytical Chemistry,* v. 19, Jan. 1947, p. 71. [Formerly *Industrial and Engineering Chemistry (Analytical Edition).*]

System results in consistent improvement in reproducibility.

For additional annotations indexed in other sections, see: 6-15; 18-17.

11 INSTRUMENTS Laboratory Apparatus

11-1. Report of the Electron Microscope Society of America's Committee on Resolution. *Journal of Applied Physics,* v. 17, Dec. 1946, p. 989-996.

Resolving power and resolution, and the various known or suggested methods for quantitative or qualitative evaluation of this factor.

11-2. A Machine for the Application of Sand in Making Fourier Projections of Crystal Structures. Dan McLachlan, Jr. and E. F. Champaygne. *Journal of Applied Physics,* v. 17, Dec. 1946, p. 1006-1014.

Method used in building models of two-dimensional Fourier projections in crystal structure analysis. Results illustrated by projections of known structures. Several advantages of this method over the Bragg photographic method are pointed out.

11-3. Trentini Surface Tester. *Industrial Diamond Review,* v. 6, Dec. 1946, p. 375.

Swiss instrument in which surface finish or roughness is measured by producing shocks in an electrical system. These shocks are produced by drawing a needle with a blunt point across the surface at constant velocity and under constant load, the magnitude of the impulses being proportional to the roughness of the measured surface.

11-4. La Realisation et les Applications des Diagrammes de Reflexion en Radiocristallographie. (Realization and Application of Reflection Diagrams in X-Ray Crystallography.) J. Bernard. *Métaux et Corrosion,* v. 21, March 1946, p. 33-39.

A number of examples of possible applications of the method of reflection diagrams in X-ray crystallography. Most of them have been successfully applied on an industrial scale.

11-5. Control and Measurement of Surface Finishes. James A. Broadston. *Steel,* v. 120, Jan. 13, 1947, p. 82, 116, 118, 121.

Some ideas that will assist in making proper selection of surface finish measurement instrumentation. Importance of surface quality control.

11-6. New Method of Electrolytic Polishing of Electron Microscope Samples. E. Der Mateosian. *Iron Age,* v. 159, Jan. 16, 1947, p. 51-53.

New method of electropolishing metal surfaces so that replicas for use with the electron microscope can be duplicated. A feature of this process is the use of chilling to expand the pH range in which polishing can be observed.

11-7. Metallizing Applications. *Electronics,* v. 20, Jan. 1947, p. 192, 194.

Outlines four applications of the deposition of thin metallic layers from the vapor state. Three are for electronic use, the fourth is used in Russia as an extremely fast method for preparing a series of alloys for study of their properties.

11-8. Profile and Surface Analysis. Part II. *Aircraft Production,* v. 8, Dec. 1946, p. 557-560.

Combined mechanical and optical methods for checking by projection as applied to surfaces of certain components, including valve sleeves.

11-9. Types of Strain Measuring Devices and Their Range of Utility. Karl F. Smith. *Product Engineering,* v. 18, Jan. 1947, p. 107-110.

Data for selecting the proper extensometer, strain gage, or strainometer to suit a given application, particularly in the field of metallic materials. Survey of types of instruments and their limitations is based upon author's experience with the different strain gages used at Battelle Memorial Institute.

11-10. Electrical Indicating Instruments. L. F. Parachini. *Product Engineering,* v. 18, Jan. 1947, p. 123-131.

Fundamental mechanisms, operating characteristics, and range of functional uses of generally used electrical indicating instruments. Moving iron, electrodynamometer, and permanent magnet moving coil types, plus guidance on using common accessories such as shunts, instrument transformers, dry rectifiers and thermocouples.

11-11. A Very High Impedance R.M.S. Voltmeter for Iron Testing. D. C. Gall. *Journal of Scientific Instruments,* v. 23, Dec. 1946, p. 287.

Design of a valve amplifier for use in conjunction with an a.c. indicating voltmeter. The device is applicable to inspection of iron samples.

For additional annotations indexed in other sections, see: 12-11; 18-17; 27-11-22.

12 INSPECTION AND STANDARDIZATION

12-1. Sensible Standardizations With Statistical Quality Control. Clifford W. Kennedy. *Production Engineering & Management,* v. 18, Dec. 1946, p. 75-78, 80.

Practical approach to a statistical system which will reduce salvage, lessen scrap loss and increase usable product output by controlling dimensional quality directly at the machine tool.

12-2. Modern Laboratory Geared to Production. *Steel,* v. 119, Dec. 30, 1946, p. 64-66, 110.

Providing facilities for carrying on routine and special chemical and physical tests on materials going into automotive parts, the new metallurgical laboratory at White Motor Co. is an excellent example of how modern planning can save steps and speed production by efficient processing of test samples. Department is equipped to check all bar stock, forgings and

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Exhibitors in Western Metal Exposition

Acme Associates, Los Angeles
Acme Tool Co., New York
Air Reduction Sales Co., New York
Air Speed Tool Co., Los Angeles
Allegheny Ludlum Steel Corp., Brackenridge, Pa.
Allen Manufacturing Co., Hartford, Conn.
Allied Products Corp., (Richard Bros. Div.), Detroit
Alloy Rods Co., York, Pa.
Allube Corporation, Glendale, Calif.
Ambrit Industries, Glendale, Calif.
American Wheelabrator & Equipment Co., Mishawaka, Ind.
Ampco Metal, Inc., Milwaukee
Austenal Labs., Inc., New York

Baldwin Locomotive Works, Eddystone, Pa.
Barrett Cravens Co., Chicago
Bartells Co. of Calif., E. J., San Francisco
Bausch & Lomb Optical Co., Rochester, N. Y.
Benbow Manufacturing Co., Redwood City, Calif.
Black Drill Co., Cleveland
Blakeslee & Co., G. S., Chicago
Braeburn Alloy Steel Corp., Braeburn, Pa.
Bristol Co., Waterbury, Conn.
Brown Instrument Co., Philadelphia
Bryant Heater Co., Cleveland
Buehler, Ltd., Chicago
Buehrer Associates, E. C., San Francisco

California Saw Works, San Francisco
Carborundum Co., Niagara Falls, N. Y.
Carpenter Steel Co., Reading, Pa.
Cerro de Pasco Copper Corp., New York
Coffing Hoist Co., Danville, Ill.
Commander Mfg. Co., Chicago
Composite Die Supply Co., Los Angeles
Composite Forgings, Inc., Detroit
Coulter Steel & Forge Co., Emeryville, Calif.

DCMT Sales Corp., New York
Detrex Corp., Detroit
Diamond Machine Tool Co., Los Angeles
DoAll Co., Minneapolis
DoAll San Francisco Co., San Francisco

Eclipse Fuel Engineering Co., Rockford, Ill.
Edwards, Inc., S. H., Richmond, Calif.
Electric Steel Foundry Co., Portland, Ore.
Electro Metallurgical Co., New York
Electro Refractories & Alloys, Buffalo, N. Y.
Electroloy Co., Inc., Bridgeport, Conn.
Elwell Parker Electric Co., Cleveland
Enterprise Engine & Foundry Co., San Francisco
Eutectic Welding Alloys Corp., New York
Everede Tool Co., Chicago

Farrar Industrial Products Co., Los Angeles
Federal Machine and Welder Co., Warren, Ohio
Federal-Mogul Corp., Detroit
Foxboro Co., Foxboro, Mass.
Frontier Bronze Corp., Niagara Falls, N. Y.

General Electric Co., Schenectady, N. Y.
General Electric X-Ray Co., Schenectady, N. Y.
General Foundry Service Co., Oakland
General Metals Corp., Oakland, Calif.
Gordon Electronics, Inc., Pittsburgh

H & H Research Co., Detroit
HPL Manufacturing Co., Cleveland
Hamilton Mfg. Co., Two Rivers, Wis.
Hammond Machinery Builders, Inc., Kalamazoo, Mich.
Handy & Harman, New York
Harnischfeger Corp., Milwaukee, Wis.
Haven Saw & Tool Co., Oakland, Calif.
Haynes Stellite Co., Kokomo, Ind.
Hevi Duty Electric Co., Milwaukee
Hough Co., Frank G., Libertyville, Ind.
Houghton & Co., E. F., Philadelphia
Hydropress, Inc., New York

Illinois Testing Labs., Inc., Chicago
Immersion Heating Equipment Co., Los Angeles
Induction Heating Co., New York
Industrial Steel Treating Co., Oakland, Calif.
International Nickel Co., New York

Jensen Instrument Co., Los Angeles

Kaiser Co., Oakland, Calif.
King, Andrew, Narberth, Pa.
King & Co., O. L., San Francisco
Kingwell Brothers, Ltd., San Francisco
Knapp Co., James H., Los Angeles

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castings used in White trucks, and to supplement the inspection work of test stations located throughout the Cleveland factory. Examines service failures and recommends redesign or change of material; carries on experimental heat treating, X-rays castings, conducts metallographic examinations and makes routine checks on lubricants.

12-3. One in Ten an Inspector. *Steel,* v. 119, Dec. 30, 1946, p. 70-72.

At Monroe Auto Equipment Co. inspection is supervised by the men who design the products and the men who design the tools on which the products are made. Inspection department, including engineers and tool designers, report directly to the management of the company. Revamped inspection setup makes possible the production of higher quality parts than those manufactured in the smaller prewar output.

12-4. Inspection and Packing of Sewing Needles. *Machinery (London),* v. 69, Nov. 28, 1946, p. 683-687.

Touch inspection; sticking in cloth strips; "furnishing" in paper wrapper; loose wrapping.

12-5. How to Use Statistical Methods in Quality Control. Robert J. Davis. *Chemical Engineering,* v. 53, Dec. 1946, p. 115-117.

Applications of the method; acceptance control; finished product control; illustrated with tables and charts.

12-6. Shop Manual on Gage Usage Helps Inspector and Operator. William P. Wehlau and D. Thorburn. *American Machinist,* v. 91, Jan. 2, 1947, p. 79-81.

Recommends procedures for using various types of gages. Pointers for inspectors and operators.

12-7. Economic Aspects of Standardization. John F. Cramer. *Fasteners,* v. 3, no. 5, 1946, p. 6-9.

Comparative costs of bolts used on B-29 planes indicates a saving of about $400 per plane due to use of standardized internal wrenching bolts.

12-8. Quality Control of Automotive Valve Line Production. E. F. Gibian. *Tool & Die Journal,* v. 12, Dec. 1946, p. 76-84.

Application of statistical control procedures to line production illustrated by example dealing with the manufacture of automotive valves. Formulation of a quality control program; preliminary findings; statistical control of individual operations; conditions prior to the installation of statistical process control; rules for statistical control in line production.

12-9. Betatron—a New Inspection Tool for Industrial Applications. *Electrical Manufacturing,* v. 39, Jan. 1947, p. 126-128, 130.

The commercial Betatron developed by Allis-Chalmers and its applications.

12-10. Statistical Quality Control in Its Application to Specification Requirements. *American Society for Testing Materials Symposium,* Nov. 1946, 15 p.

Introductory remarks, two papers, and discussion. Goffman and Manuele give details of the use of statistics in writing specifications. Colonel Simon tells how intelligent use of specifications at Aberdeen Proving Ground cut inspection costs and resulted in improved products.

12-11. Inspecting Turbosupercharger Blades by Optical Projection Comparator. E. C. Polidor. *Iron Age,* v. 159, Jan. 16, 1947, p. 40-44.

How this can now be done rapidly and accurately by the use of a newly developed instrument known as the Pant-O-Jector. Using a beam of light to trace the profile on a special comparator chart not only indicates the form of the blade but also locates it in relation to the center of gravity.

12-12. Engineering and Quality Control. P. L. Alger. *Electrical Engineering,* v. 66, Jan. 1947, p. 16-19.

Laws of chance, sampling theory and quality control procedures. Interpretation of control charts illustrated by samples showing variations in Brinell hardness.

12-13. Quality Control Handbook. Eugene Goddess. *Steel,* v. 120, Jan. 20, 1947, p. 70-73.

Step-by-step procedures in which a quality control program is established that provides a permanent record. This will furnish information regarding the state of control at each machine and thus improve production.

12-14. Popular Types of Steels. G. D. Boyer. *Product Engineering,* v. 18, Jan. 1947, p. 81-85.

Current trends toward standardization in the specification of bar stock steels for use in the manufacture of industrial products. Desirability of standardizing on the most popular steels to minimize procurement difficulties. Machinability characteristics of the various steels.

12-15. The Betatron. W. Bosley. *Journal of Scientific Instruments,* v. 23, Dec. 1946, p. 277-283.

Theory, development, and applications. Diagrams and photographs.

12-16. The Active Portion of Involute on External Spur and Helical Gears. Sidney Cornell. *Machinery,* v. 53, Jan. 1947, p. 150-154.

Knowing the active portion of involute gear teeth permits the use of profile recording machines with greater accuracy and with less danger of damage to the instrument. Method of determining the used portion of the involute developed and applied to its measurement.

12-17. Inspecting and Measuring Jet-Propulsion Blades. *Machinery,* v. 53, Jan. 1947, p. 185-188.

Standard comparator, such as is employed for the inspection of precision screw-thread profiles, is equipped to provide an accurate and rapid method of inspecting jet-propulsion and turbine blades. "Pant-O-Jector" equipment combines the operating principles of a pantograph and an optical projector. Blade to be inspected is gripped by its root in the workholding fixture, which can be adjusted to hold the blade surface to be checked in the required position.

12-18. Precision Method of Checking Compound Angles. James Ahearn. *Machinery,* v. 53, Jan. 1947, p. 178-181.

Meets the needs of precise checking, and at the same time provides a quick setup for repetitive inspection.

12-19. A Statistical Survey of Some Hardened Steel Forgings. Roger F. Mather. *Metal Progress,* v. 51, Jan. 1947, p. 79-85.

During three years of production of the Willys "Jeep" and its trailer, statistical surveys of the physical properties of heat treated steel parts were made. Shows how writing of specifications for tensile properties may be improved by using results of such a study.

12-20. Radiography of Spot Welds in Various Sheet Gages and Dissimilar Gage Combinations. R. C. McMaster, F. C. Lindwall and L. P. Gaard. *Welding Journal,* v. 26, Jan. 1947, p. 19-29.

Experimental results of work done on 24S-T alclad aluminum alloy sheets.

12-21. The Detection of Cracks in Steel by Means of Supersonic Waves. C. H. Desch, D. O. Sproule, and W. J. Dawson. *Welding Journal,* v. 26, Jan. 1947, p. 1s-25s.

Previous methods; theoretical considerations; apparatus and techniques; and a few typical results. This is practically a manual on the subject. Extensively illustrated.

For additional annotations indexed in other sections, see:
3-18-23; 4-3; 11-8; 14-19; 27-4.

13 PYROMETRY Temperature Control

13-1. Improvement in Design of Immersion Pyrometers for Liquid Steel. D. Manterfield and J. R. Thurston. *Blast Furnace and Steel Plant,* v. 34, Dec. 1946, p. 1520-1521, 1535-1536.

Details of design for a permanent or semipermanent immersion thermocouple installation which may be attached to the furnace backwall. This design eliminates several difficulties inherent in previous procedures. The thermocouple and protection tube is immersed by means of a pulley and hand-winch apparatus.

13-2. Recording Surface Heats With Radiation Pyrometer. *Steel,* v. 119, Dec. 30, 1946, p. 74.

Radiation type of heat recorder takes the external temperature of nearly white-hot slabs of steel as they pass in review in the heating furnace preparatory to entrance in rolling mills. In addition to making certain that slabs reach the prescribed temperatures, pyrometer aids research in the design of effective furnaces, locating heat leaks and other points of inefficiency. Long-handled, malletlike instrument, which may be operated by one man, is designed to perform successfully up to a slab surface temperature of 2400° F.

13-3. What We Have Learned About Upkeep of Pyrometric Equipment. P. L. Stapleton. *Factory Management and Maintenance,* v. 104, Dec. 1946, p. 140-143.

Organization of maintenance and repair activities for the 2400 pyrometric instruments in General Electric's Schenectady plant.

13-4. Instrumentation—A Must at the Ford River Rouge Plant. *Instrumentation,* v. 2, Jan-Feb. 1947, p. 3-7.

Instrumentation includes that applied to steel production and heat treating operations.

13-5. High Nickel-Chromium Alloys Increase Thermocouple Life. *Instrumentation,* v. 2, Jan-Feb. 1947, p. 29-30.

Gas tightness and resistance to high-temperature corrosion; time lag of thermocouples protected by these alloy tubes.

For additional annotations indexed in other sections, see:
11-10.

14 FOUNDRY PRACTICE

14-1. Foundry Practice in Argentina. Eugene J. Ash. *Foundry,* v. 75, Jan. 1947, p. 72-73, 182-183, 186-187.

Impetus given by the war to foundry production; history of foundries in Argentina; quality; primitive methods; lack of sand control; availability of raw materials; attempts at mechanization.

14-2. Synthetic Sand in the Nonferrous Foundry. Stanley W. Brinson. *Foundry,* v. 75, Jan. 1947, p. 80-84, 233-234.

Purchase inspection and tests, core sand mixes, and routine control devices used in the nonferrous foundry of the Norfolk Naval Shipyards.

14-3. Pilot Foundry Aids Product De-

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(Continued from page 25)

Lectroetch Co., Cleveland
Leeds & Northrup Co., Philadelphia
Lempco Products Co., Bedford, Ohio
L'Hommedieu & Sons Co., Chas. F., Chicago
Light Metal Age, San Francisco
Lincoln Electric Co., Cleveland
Lindberg Engineering Co., Chicago
Linde Air Products Co., New York
Los Angeles Department of Water & Power, Los Angeles

Magnaflux Corp., Chicago
Magnelux, Inc., Los Angeles
Mall Tool Co., Chicago
Marwedel, C. W., San Francisco
Material Movement Industries, Chicago
Metal Finishing Service, Chicago
Metal & Thermit Corp., New York
Metallizing Co. of America, Chicago
Metaloy Sprayer Co., New York
Modernair Corp., Oakland, Calif.

National Cylinder Gas Co., Chicago
National Industrial Launderers & Cleaners Assoc., Indianapolis
National Pneumatic Co., Rahway, N. J.
Natural Gas Equipment Co., Inc., San Francisco
North American Philips Co., New York
Norton Co., Worcester, Mass.

Oakite Products, Inc., New York
Oakland Chamber of Commerce
Ohio Crankshaft Co., Cleveland
Oliver Tire and Rubber Co., Oakland
Olsen Testing Machine Co., Tinius, Philadelphia

Pacific Abrasive Supply Co., San Francisco
Pacific Coast Gas Assoc., San Francisco
Pacific Gas & Electric Co., San Francisco
Pacific Graphite Co., Emeryville, Calif.
Pacific Metals Co., San Francisco
Pacific Scientific Co., San Francisco
Pacific Steel Casting Co., Berkeley, Calif.
Pangborn Corp., Hagerstown, Md.
Perin, Ira, San Francisco
Permanente Metals Corp., Oakland, Calif.
Physicists Research Co., Ann Arbor, Mich.
Pines Engineering Co., Aurora, Ill.
Porter Cable Co., Syracuse, N. Y.
Powder Weld, Inc., Brooklyn, N. Y.
Production Enginering Cons., Los Angeles
Progressive Welder Co., Detroit

Radio Corp., of America, Camden, N. J.
Rapids-Standard Co., Inc., Grand Rapids, Mich.
Reliance Electric & Engineering, Cleveland
Richards Brothers Div., Allied Products Corp., Detroit
Richards Co., J. A., Kalamazoo, Mich.
Riley Precision Tool Co., San Francisco
Ryerson & Son, Inc., Joseph T., Chicago

"S" Corrugated Quenched Gap Co., Garfield, N. J.
Schneible Co., Claude B., Detroit
Scott & Son, Inc., C. U., Rock Island, Ill.
Shelden Machine Co., Inc., Chicago
Simonds Saw & Steel Co., Fitchburg, Mass.
Smith Co., Lombard, Los Angeles
Solventol Chemical Products, Inc., Detroit
Sommer & Adams Co., Cleveland
South Bend Lathe Works, South Bend, Ind.
Southern California Industrial Cleaners Assoc., Los Angeles
Spencer Turbine Co., Hartford, Conn.
Squires Co., H. B., San Francisco
Stuart Oxygen Co., San Francisco
Stuart Oil Co., D. A., Chicago
Sullivan-Cassimus Co., San Francisco

Taylor-Winfield Corp., Warren, Ohio
Texas Co., New York
Tinnerman Products, Inc., Cleveland
Torrington Mfg. Co., Torrington, Conn.

Union Carbide & Carbon Co., New York
U. S. Department of Commerce, San Francisco
U. S. Hoffman Machinery Corp., New York
Upton Electric Furnace Co., Detroit

Vacu Blast Co., Burlingame, Calif.
Vapor Blast Mfg. Co., Milwaukee
Victor Equipment Co., San Francisco

Waldes-Kohinoor, Inc., Long Island City, N. Y.
War Assets Administration, Washington, D. C.
Warren City Mfg. Co., Warren, Ohio
Wells, Inc., Martin, Los Angeles
Western Machinery and Steel World, San Francisco
Western Metals, Los Angeles
Westinghouse Electric Corp., Pittsburgh
Wilson Mechanical Instrument Co., New York

Yale & Towne Mfg. Co., Philadelphia

velopment. G. W. Birdsall. *Foundry,* v. 75, Jan. 1947, p. 90-91, 234-235.
Reynolds Metals Co.'s experimental aluminum foundry.

14-4. Formulas for Determining the Weights of Castings. (Continued.) *Foundry,* v. 75, Jan. 1947, p. 121-122.
Formulas for pyramid with hexagonal base, frustrum of a hexagonal pyramid, sector of a spherical segment of one and two bases, ring made by cutting a cylindrical hole through a sphere, and ring of triangular cross-section tables for quick solution.

14-5. The Pattern Shop and Our National Economy. Arthur J. Tuscany. *Foundry,* v. 75, Jan. 1947, p. 79, 216, 218, 220, 222, 224.
Benefits to be derived from co-operative effort in industry, with special reference to patternmakers.

14-6. Casting Aluminum Billets for Extruding. R. W. Graham. *Iron Age,* v. 158, Dec. 26, 1946, p. 52-54.
Melting and casting of aluminum billets to meet the exacting demands of extruding operations. Use of book type molds and the direct chill process.

14-7. New Binders Improve Core Performance. H. L. Gebhardt. *Iron Age,* v. 158, Dec. 26, 1946, p. 66-68.
Practical advantages accruing from the use of synthetic resin core sand binders. Among the characteristics imparted to cores by the recently perfected binders are faster baking; lower baking temperatures; faster collapsing; favorable tensile and compression strength; hard, dense surfaces and softer centers; and moisture resistance in the cured condition. Behavior of these binders under dielectric heat.

14-8. New Methods of Melting in the Cupola. V. M. Andreyeff. *Engineers' Digest,* v. 3, Nov. 1946, p. 576.
Modified cast iron can be obtained only by superheating of the molten metal, which may be done by stimulating the formation of CO_2 rather than CO in the cupola. Best results have been obtained by adding a few more rows of tuyeres, properly spaced. An improved recuperator is also discussed. (Condensed from 3rd Technical-Scientific Conference of the Kalinin Polytechnic Institute, Leningrad, Sept. 1944, p. 73-75.)

14-9. Cupola Stock Height. *Gray Iron Progress,* v. 3, Dec. 1946, p. 2-3.
"Stock height" is the distance from the top of the tuyeres to the top of the charges in the stack. Results of a series of tests made to determine the effects of variations.

14-10. Large Coke Vs. Small Coke. *Gray Iron Progress,* v. 3, Dec. 1946, p. 3-4.
Three sizes of coke were evaluated in cupola operation at Buflovak Equipment Division of Blaw-Knox. No great changes were noticed in the size range used (2x5 to 5x9 in.), although there were differences in percent of carbon dioxide in stack gas and in blast pressure, which may be important to foundries using centrifugal blowers.

14-11. Cupola Stack Gases. *Gray Iron Progress,* v. 3, Dec. 1946, p. 4-6.
Economic value of stack gas Co_2 control. Chart shows relation between CO_2 content, CO content, and heating value per pound of carbon. In tests on sized coke, 2x5-in. coke produces 10.6% CO_2 in the stack as compared to 12.2% when 5x9-in. coke was burned. Thermal output from the small coke was only 92.5% of that from the large.

14-12. What Does It Cost? *Gray Iron Progress,* v. 3, Dec. 1946, p. 6-8.
The costs of refractory burn-out in cupola operation. Considers less obvious factors than the cost of the refractory material, such as the coke required to fill the space left by the burn-out, the amount of limestone used to flux the lining, the amount of heat required, and the labor to haul away the slag. Suggestions for minimizing the losses.

14-13. All-Scrap Mixes. *Gray Iron Progress,* v. 3, Dec. 1946, p. 8-9.
Some of the problems encountered in using all-scrap mixes in the foundry and how to combat them.

14-14. Some Examples of Quality and Quantity Production of Iron Castings. F. Andrew. *Foundry Trade Journal,* v. 80, Nov. 21, 1946, p. 283-288.
Methods adopted in the production of large quantities of good quality castings at Ferranti, Ltd., with particular emphasis on mechanization and improvements in patternmaking. (Paper read before the Lancashire branch of the Institute of British Foundrymen.)

14-15. Malleable Foundry Industry. J. R. Roxburg. *Foundry Trade Journal,* v. 80, Nov. 21, 1946, p. 289-291.
Current practice and chief postwar problems. (Presidential address to East Midlands branch of the Institute of British Foundrymen.)

14-16. Opkoling in den Koepeloven. (Carburization in a Cupola Furnace.) H. S. H. Ritzen. *Metalen,* v. 1, Nov. 1946, p. 45-49.
Factors influencing carburization in a cupola. The time of contact of the molten iron and coke may be regulated very simply. In a cupola with a high coke bed, such regulation is also possible within certain limits.

14-17. Precision Cast Finned Cylinders. E. I. Valyi. *Materials & Methods,* v. 24, Dec. 1946, p. 1450-1451.
By means of refractory mold casting, the A. R. D. Corp. has produced, first in its laboratory, then commercially, at the plant of its licensee, the Midwest Foundry Co., a finned, hollow cylinder with fins 0.030 in. thick projecting from a cylinder wall which is 0.15 in. thick.

14-18. Patterns Made From Cast Plastics. C. R. Simmons. *Materials & Methods,* v. 24, Dec. 1946, p. 1466-1468.
Use of Durez casting resin for foundry patterns. Advantages include initial cost, ease of casting and inexpensive finishing.

14-19. Formation de Criques Successives a Chaud dans un Tube en Acier Centrifugé. (Formation of a Series of Cracks in Steel Tubes Produced by Centrifugal Casting.) J. Caillaud. *Comptes Rendus,* v. 223, Nov. 4, 1946, p. 729-731.
Defects may be caused by the quality of sand used for molds, by the type of steel used for high-temperature casting (low deformability), and by the conditions of centrifuging (excessive speed of rotation.)

14-20. Some Factors to Consider When Purchasing Core Sand. H. Louette, A. E. Murton, and H. H. Fairfield. *Canadian Metals & Metallurgical Industries,* v. 9, Dec. 1946, p. 20-23.
Specifying grain size only in purchasing core sand is not a sufficient precaution to insure that suitable sand will be obtained. The pronounced effect of grain shape upon many of the properties of core sand mixtures. Rounded sand grain has many advantages over the angular shaped grain; these include lower core oil consumption, easier coremaking operations, and less gas and smoke in the foundry.

14-21. Influence of Design and Patternmaking on Foundry Technique. T. H. Sneddon. *Foundry Trade Journal,* v. 80, Dec. 12, 1946, p. 365-369.
Construction of a cheap pattern and also the design and construction of a first-class pattern for use in a repetitive or semirepetitive foundry. (Paper read before the Scottish branch of the Institute of British Foundrymen. To be continued.)

14-22. Centrifugal Casting of Aluminum for Squirrel-Cage Rotors. Albert R. Hemstreet. *Electrical Manufacturing,* v. 39, Jan. 1947, p. 100-101.
To speed up rates of production using advantages of solid aluminum conductor structure, an air-operated centrifugal casting machine has been developed, capable of completing a casting cycle in 15 sec.

14-23. Foundry Control. W. A. Baker. *Metal Industry,* v. 69, Dec. 20, 1946, p. 505-507.
The various operations involved in the production of a casting, from the drawing board to the finished article, together with their priorities in the scheme of control. (Based on a paper presented before the Manchester Metallurgical Society. To be concluded.)

14-24. Die Casting. *Metal Industry,* v. 69, Dec. 20, 1946, p. 507.
Methods employed by German technicians reported after visit to eight German firms all engaged in the light alloy die-casting industry.

14-25. Experiments With a Foundry Test for the Fluidity of Molten Steel. L. W. Sanders and C. H. Kain. *Foundry Trade Journal,* v. 80, Dec. 5, 1946, p. 339-343.
A practical testpiece suitable for use in the foundry. Results indicate that consistently reproducible results may be obtained within narrow limits.

14-26. Some Problems in Cast Iron. Eugene Piwowarsky. *Iron Age,* v. 159, Jan. 9, 1947, p. 58-60.
Results of some wartime investigations covering hot blast cupolas, special melting units, rolled cast iron, heat and scale resistant and armored iron.

14-27. Semicontinuous Casting. *Metal Industry,* v. 69, Dec. 20, 1946, p. 515-516.
Plants in the Ruhr engaged in the production of wrought light alloys made great use of semicontinuous casting processes, one of the plants visited using a patented method known as the "sliding face mold". Many advantages are claimed for this method including those of almost complete prevention of oxidation, low internal stresses, good surface finish, very fine grain structure and a good sheet from ingot ratio. (Abstracted from report by the British Intelligence Objectives Sub-Committee.)

14-28. Selection of Alloys in the New Jack & Heintz Engines. *Die Castings,* v. 5, Jan. 1947, p. 18-20, 37-43.
Information on the selection of alloys, design factors, die castings practice, mechanical function, and performance characteristics.

14-29. Foundry Control. (Concluded.) W. A. Baker. *Metal Industry,* v. 69, Dec. 27, 1946, p. 530-532.
Control of metal composition and condition through study of casting process and also observation of it in operation with rectification where necessary.

14-30. Knock-Off Risers. S. W. Brinson and J. A. Duma. *Metal Industry,* v. 69, Dec. 27, 1946, p. 533-534.
Application of risers which, without any apparent impairment of feeding efficiency or metal quality, fall off the castings in the shakeout or are flogged off with one blow of a hand sledge. (Paper presented to A.F.A.)

14-31. Semicontinuous Casting. H. Hocking. *Metal Industry,* v. 70, Jan. 3, 1947, p. 13.
Developments for increasing output in the light alloy foundry. Latest designs of casting machines. Machining the cast billets.

14-32. Influence of Design and Patternmaking on Foundry Technique. (Continued.) T. H. Sneddon. *Foundry Trade Journal,* v. 80, Dec. 19, 1946, p. 393-396.
Deals with jobbing, semirepetitive and repetitive work in a steel foundry producing light castings, weighing from 1 to 70 lb. Redesigning of hand molding patterns.

14-33. Drying of Foundry Sand Cores by Dielectric Heat. J. R. Calhoun, L. E.

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Metallic Filters and Alloy Welding Rod Among Powder Metal Applications

Reported by Frank Kristufek
U. S. Steel Corp. Research Laboratory

For certain mass-production items, the powder metallurgy process is superior to others from a cost and product performance standpoint, according to J. F. Sachse, chief metallurgist of the Metals Disintegrating Co., Inc., who discussed the applications of powder metallurgy at the November meeting of the New Jersey Chapter.

Established applications of metal powders in fields other than fabrication include the use of copper powders for furnace brazing of assemblies, aluminum and magnesium for pyrotechnic purposes, and metallic pigments for decorative purposes. Iron and copper powders are now used extensively as reagents and catalysts in organic syntheses.

"Natural" applications of the powder metallurgy process are many and varied, according to Mr. Sachse. The porosity of parts produced by this method may be controlled, a special advantage where impregnation with oil affords a self-lubricating surface or where the sintered part is to serve as a filter. Such metallic filters played an important role in the development of the proximity fuse. An alloy welding rod is now being produced by extruding the alloying elements in powder form around a drawn wire of the base metal in much the same manner as in flux coating of welding rods. Although powder metal parts are usually considered suitable only for low-stressed items, a typical use mentioned by Mr. Sachse is in the production of automotive brake and clutch faces and aircraft landing brakes.

Powder metallurgy with brass developed during the early stages of the war and has a field of application still to be realized, according to the speaker. Trouble was first encountered because the zinc tended to volatilize during the sintering process but this difficulty has largely been overcome.

The nonstandard nature of manufacturing methods has hampered the growth of the powder metallurgy industry although this is a natural result of the youth of the industry, stated Mr. Sachse. The Metal Powder Association, for example, is a little over two years old and still does not number many of the most prominent of powder metallurgy fabricators among its members. Almost all of the important producers of metal powders actively support it, however.

Following the discussion period presided over by technical chairman Jacob Kurtz, an excellent display of powder metallurgy parts was exhibited by the speaker.

New Portland Research Firm

Harry Czyzewski, formerly staff metallurgist in the research department of the Caterpillar Tractor Co., Peoria, Ill., and David B. Charlton, owner of Charlton Laboratories, Portland, have established Metallurgical Engineers, Inc., in Portland, Ore. This organization will furnish services in the testing, consulting, design and development of metal products and processes in the Pacific Northwest.

Convention Papers Invited

A cordial invitation is extended to all members of the American Society for Metals to submit technical papers for presentation before the 29th National Metal Congress and Exposition to be held in Chicago next October. Papers will be considered by the Publication Committee of the Society, and three copies accompanied by three sets of drawings and illustrations should be sent to the National Office in Cleveland to the attention of Ray T. Bayless, assistant secretary, American Society for Metals, not later than June 1, 1947.

Headquarters should be notified of your intention to submit a paper, and helpful suggestions for the preparation of technical papers will be sent.

Dental and Jewelry Uses Of Precious Metals Shown

Reported by A. R. Kunkle
Project Engineer, York Corp.

Opening a talk on "Precious Metals" before the York Chapter on Dec. 11, O. E. Harder of Battelle Memorial Institute, past national president, presented a comparison of eight metals from the standpoint of density, melting point, boiling point, cost, and type of lattice structure.

Most of these metals—namely, gold, silver, platinum, palladium, osmium, ruthenium, iridium, and rhodium—are being used today in dental work and jewelry. The physical properties required for applications in dental work determine which metals are used as the alloying agent with gold and silver.

Gold and silver were discussed at some length, particularly as applied in the jewelry trade. Dr. Harder explained the terms "gold filled" and "gold plate", and presented typical examples of each.

Upon request, Dr. Harder referred briefly to Vitallium and the use of precision casting to avoid machining of this extremely hard metal.

Wood Describes Fabrication Methods For Magnesium

Reported by Russell L. Wilcox
Draftsman, Bethlehem Steel Co.

Properties of magnesium alloys that are different from those of other alloys, thus necessitating particular fabrication methods, were enumerated by Robert T. Wood, chief metallurgist, American Magnesium Co., before the November meeting of the Baltimore Chapter. His subject was "Magnesium Fabrication and Applications", and an excellent set of slides was used to illustrate the various points.

Mr. Wood described the casting, forging, extruding, and fabrication of sheet, for the various magnesium alloys, and explained how these operations affect the grain structure.

Among the applications of magnesium alloys is its well-known adaptability to aircraft because of its light weight. In the textile industry more and more uses are being developed for magnesium. Magnesium finds particular application where light weight combined with ruggedness, rigidity and freedom from buckling are desirable, as well as in the many places where stresses are low and where an efficient design in stronger competing materials would result in sections too flimsy or too thin to fabricate.

After Mr. Wood had cheerfully and capably answered the many questions of the members, the meeting was adjourned to the "end-quench" operation of pretzels, potato chips and beer.

The dinner preceding the meeting was addressed by Douglas Turnbull as coffee speaker. Mr. Turnbull is one of the famous names in the game of lacrosse in this part of the country.

A. R. Stargartder Joins Washington Steel Corp.

A. R. Stargartder has recently been named chief metallurgist of the Washington Steel Corp., Washington, Pa. After graduating from Johns Hopkins University in 1916, he became associated with the steel industry, and he has maintained this connection ever since. Mr. Stargartder has been chief metallurgist for Eastern Stainless Steel Corp. and the Gillette Safety Razor Co., where he developed the "blue blade". During the war he served as a member of the War Production Advisory Committee. He has been a member of the American Society for Metals since 1920 and an officer of the Baltimore chapter.

A. R. Stargartder

Clark and H. K. Salzberg. *Foundry Trade Journal,* v. 80, Dec. 19, 1946, p. 405-406, 410.

Results of experiments show modern method of drying materials of high dielectric strength by placing them in a high-frequency electric field can be applied to foundry sand cores. (From an article published in *Industrial Ovens.*)

14-34. Recent Developments in Cast Iron Research. Harold Hartley. *Engineering,* v. 162, Dec. 20, 1946, p. 595-596.

British Cast Iron Research Association has developed a method for production of an improved cast iron having a nodular graphite structure. Tensile strength, elongation, shock resistance, and Brinell hardness were greatly improved. The material is said to possess the properties of present "high-duty" cast irons although special compositions or treatments are not required. The method is not described.

For additional annotations indexed in other sections, see:
2-8; 3-4; 4-6; 8-3; 18-4-5; 19-24-27-30; 23-8; 24-20; 27-8.

15 SALVAGE AND SECONDARY METALS

15-1. Scrap Recovery. F. F. Poland. *Metal Industry,* v. 69, Dec. 6, 1946, p. 466-467, 470.

Zinc distillation and the refining of copper-base alloys.

15-2. Ford Reorganizes Salvage Department Due to Changed Conditions. Leonard Westrate. *Automotive and Aviation Industries,* v. 96, Jan. 1, 1947, p. 30-31, 54.

Organization of new system, which resulted from critical examination of costs. Tool salvage; scrap handling.

For additional annotations indexed in other sections, see:
22-1; 26-4-7.

16 FURNACES AND FUELS

16-1. Enameled Screen Gives Best Results in Screening Coke Breeze and Damp Materials. Fred J. Geyer. *Blast Furnace and Steel Plant,* v. 34, Dec. 1946, p. 1529-1530.

Difficulty with clogging was experienced in screening $+\frac{3}{16}$ to $+\frac{5}{8}$-in. coke breeze. Several methods for alleviating the difficulty were tried without success. Finally, application of an enamel coating solved the problem. Useful for screening any damp material.

16-2. Continuous Heating and Heat Treatment of Bar Stock and Tubing. Frederic O. Hess. *Industrial Gas,* v. 25, Dec. 1946, p. 10-11, 25-26.

Continuous heat treating furnace setup for use in the reheating operation required before final tube sizing in the seamless tube mills. Substitution of continuous for batch methods eliminates surface decarburization.

16-3. The Rotating Electric Arc Furnace. T. Ellefsen. *Engineers' Digest,* v. 3, Nov. 1946, p. 570.

Crater formation in the electric arc furnace is eliminated by a rotating furnace with stationary electrodes in use in Norway. Construction details. Six-month tests resulted in 17% increased production and 10% saving in charge material. It has been used only for iron alloys, but is recommended for calcium carbide and other materials; suggested for controlled atmosphere smelting. (Condensed from *Journal du Four Electrique et des Industries Electrochimiques,* v. 55, June-July 1946, p. 41-44.)

16-4. The Case for Oil Firing. F. J. Erroll. *British Steelmaker,* v. 12, Dec. 1946, p. 598-600.

Pros and cons of fuel oil for British iron and steel furnaces. Change-over is facilitated by recent repeal of import tariff.

16-5. Liquid Fuel for Openhearth Furnaces. G. Reginald Bashforth. *British Steelmaker,* v. 12, Dec. 1946, p. 602-614.

Fundamentals of heat transfer; use of tar; characteristics and properties of fuel oil; advantages and disadvantages; supply and storage; oil flow; atomization; burners and burner design; furnace control; furnace design; future British prospects for use of liquid fuel.

16-6. Les Fours Rotatifs de Fusion. (Rotary Smelting Furnaces.) Paul Blanchard. *Fonderie,* Oct. 9, 1946, p. 323-334.

Basic types of rotary smelting furnaces. Advantages and disadvantages of each type compared with stationary furnaces.

16-7. The Calculation of Nickel-Chromium Resistors in Heat Treating Furnaces. Victor Paschkis. *Industrial Heating,* v. 13, Dec. 1946, p. 1972, 1974, 1976, 1978, 1980, 1982, 1984, 1986, 1988.

Mathematics concerned in the calculation of nickel-chromium resistors for electric heat treating furnaces.

16-8. Continuous Furnaces Feature Equipment of Plant of Columbia Steel Treating Co. Part II. *Industrial Heating,* v. 13, Dec. 1946, p. 2048, 2050, 2052.

Box-type furnaces, salt-bath cyaniding furnaces, fuel-oil and quenching oil handling and storage systems.

16-9. New Methods in Steel Axles. *Western Machinery and Steel World,* v. 37, Dec. 1946, p. 120-123.

Continuous rotary-hearth heating furnace, a number of gas-fired pits for control cooling of finished forgings, an axle straightener of novel design, and a number of minor auxiliaries.

16-10. Electronic Heating Requirements. A. P. Bock. *Electronics,* v. 20, Jan. 1947, p. 126.

Charts make it possible to determine amount of power required for a given heating job. Curves are given for nine common materials, and the chart can be used for any other material if its specific heat is known.

16-11. Den Elektriska Stålugnens Utveckling under Världskriget 1939-1945. (Development of the Electric Steel Furnace During the World War 1939-1945.) Erik Sunstrom. *Jernkontorets Annaler,* v. 130, no. 10, 1946, p. 477-552.

Review illustrated by charts, photographs, and diagrams includes auxiliary equipment and refractory materials. Developments, not only in Sweden, but also in the other important steel-producing countries. 34 ref.

16-12. Recirculation as Applied to Heating and Cooling on Industrial Ovens. Richard J. Ruff. *Industrial Gas,* v. 25, Jan. 1947, p. 9-10, 26-27.

Curves show comparative heating rates of aluminum wire in still air and in recirculated air. Advantages and applications of the system.

For additional annotations indexed in other sections, see:
2-3-4-5-10-11; 14-10-11; 17-5; 18-4-7; 27-10.

17 REFRACTORIES Furnace Materials

17-1. Plastic-Lined Furnace Doors. J. N. Hornak. *Industrial Heating,* v. 13, Dec. 1946, p. 2036, 2038.

Design and construction of plastic-refractory lined furnace doors. Service lives of different designs under operating conditions. (Paper presented at the recent National Openhearth Conference sponsored by the Iron & Steel Div. of the American Institute of Mining and Metallurgical Engineers.)

17-2. Recent Progress in Basic Openhearth Furnace Refractories and Masonry. Part II. *Industrial Heating,* v. 13, Dec. 1946, p. 2040, 2042, 2044, 2055-2056.

Progress in silica refractories; mixer linings; relation of insulation to operating economy; results obtained from the use of carburized, tarred and special nozzles for ladles.

17-3. Notes on Reaction Between MgO and Various Types of Refractories. C. L. Norton, Jr., and Bradford Hooper. *Journal of the American Ceramic Society,* v. 29, Dec. 1, 1946, p. 364-367.

Samples of various types were tested for reaction with magnesium oxide at various temperatures, to determine the proper refractory for use in a furnace where brickwork is exposed to magnesia dust. Photographs of the samples after exposure.

17-4. The Behavior of Quartz in Fireclay Refractories. J. Sharp Smith and Peter F. F. Clephane. *Gas Times,* v. 49, Dec. 7, 1946, p. 265-266.

Summary and discussion of paper presented at Autumn Research Meeting of the Institution of Gas Engineers, Nov. 1946.

17-5. New Method for Building Openhearth Flues. *Steel,* v. 120, Jan. 20, 1947, p. 94, 97.

Application of refractory concrete saves time in laying up flues from checkers to stack and facilitates building streamlined flues with continuously changing sections. Material costs reduced through use of salvaged materials. Rebuilding job at shop in Pittsburgh district.

17-6. On the Crystalline Structure of SiC and on the Geometrical Theory of Silicon Carbide Structures. G. Zhdanov and Z. Minervina. *Journal of Physics (U.S.S.R.),* v. 10, no. 5, 1946, p. 422-424. (In English.)

A series of X-ray investigations concerning the structure of SiC and the phase composition of several commercial specimens. Results substantiated the structural theory previously proposed by the authors.

For additional annotations indexed in other sections, see:
2-8; 14-12; 16-11; 23-5.

18 HEAT TREATMENT

18-1. A Practical Approach to Cold Treatment of Steel. Orlo E. Brown. *Materials & Methods,* v. 24, Dec. 1946, p. 1445-1449.

Methods suggested by which manufacturers of hardened steel parts can determine for themselves whether or not cold treatment will improve their product. With S.A.E. and similar steel, the checking is accomplished by simple shop tests. If the type of metal is such as to be susceptible to supercooling or supersaturation, then the hardness is checked. When the apparent hardness and Rockwell C hardness do not agree, the probability is that cold treatment will be beneficial. Actual trial will tell if the improvement obtained offsets the cost of treatment.

18-2. Straightening a Large Cast Steel Gear. *Linde Tips,* v. 26, Jan. 1947, p. 17-18.

Procedure used to flame-straighten

(Turn to page 32)

Beryllium Copper Provides Combination of Good Formability and Simple Heat Treat

Reported by G. F. Kappelt
Assistant Metallurgist
Bell Aircraft Corp.

A combination of good formability in the annealed condition and simple heat treatment accounts for many applications of beryllium copper, according to Wayne E. Martin, sales engineer for the National Smelting Co. Mr. Martin, addressing the Buffalo Chapter ⊕, covered various copper-base alloys but devoted most of his attention to beryllium copper.

Steel would serve equally as well in many finished parts, he said, but beryllium copper is more economical because it can be purchased in the annealed condition, and in this state it will take heavy cold forming operations. After cold forming, it can be hardened to about Brinell 380 by a simple heat treatment of 1½ hr. at 600° F. or 20 min. at 700° F.

Close control of the product in the rolling mill is needed to give maximum cold forming properties. Hardening of beryllium copper is done in two steps—solution annealing in the rolling mill and precipitation hardening by the manufacturer after the part has been formed to size.

Solution annealing temperature is between 1390 and 1500° F. If the lower temperature is used in annealing previously cold worked strip, a grain size of about 0.01 mm will be obtained and the annealed hardness will be about Brinell 150. If an annealing temperature on the top side of the zone is used, the annealed hardness will be about Brinell 100 and the grain size about 0.04 mm.

The lower annealing temperature with the finer grain size is more conducive to good results where an endurance load is applied in very thin strip. The higher annealing temperature with the larger grain size is more conducive to good cold formability, so the annealing temperature used by the rolling mill should be based on the requirements of the final product.

Other factors affecting cold forming characteristics of beryllium copper are the oxide surface on the strip and beta segregations. Several years ago it was found that beryllium copper containing about 1.8% beryllium could be made more nearly homogeneous and free from the beta segregations occurring in the casting than could an alloy containing 2% or more beryllium. The lower beryllium content, therefore, is often desirable where good cold forming characteristics are more important than the final hardness obtained after heat treatment.

Beryllium-copper strip sometimes shows bad formability because of the beryllium oxide surface on it. If beryllium copper is annealed in a very dry atmosphere (dew point less than 40° F.), it will come from the anneal without a refractory oxide surface. If it is annealed in a wet atmosphere, such as an open gas flame, it will come out with a black oxide which can be readily removed by pickling. If it is annealed in a fairly dry atmosphere (dew point of —20 to 0° F.), it will have a red oxide film which is very tenacious and difficult to remove in pickling. This type of oxide often causes bad formability and excessive die wear even when a cadmium plate is used to give die lubrication.

In the precipitation hardening operation at 600 to 700° F., beryllium copper becomes quite plastic and it is possible by fixture heat treatment to obtain parts of very close precision. Some work is being done at this time on hot forming of beryllium copper in this temperature range with the forming and hardening operations combined in one step.

Occasionally trouble is had with warping as the result of precipitation on the grain boundary. If large coils are placed in a furnace, heated slowly to the solution annealing temperature and quenched with a delayed quench as the result of the heavy section in the coil, metal so annealed is almost certain to show grain boundary precipitation in hardening. If beryllium copper is solution annealed in such a manner as to be heated quickly to the annealing temperature, held at temperature for a few seconds and quickly quenched, no grain boundary precipitation will occur on hardening. This latter condition can be met by strand annealing—that is by pulling a single strand through a long tube furnace.

Foundry brasses and bronzes were discussed and it was pointed out that, in view of the growing scarcity of tin, other copper-base alloys might supplant the tin bronzes. During the war, such substitutions were usually made to manganese bronze.

However, the speaker believes that a brass containing 15% zinc and 5% silicon would have many advantages over manganese bronze. Its castability is considerably better and its machinability is far better. Its physical properties fall about midway between those of gun metal and manganese bronze. Mr. Martin recommended wider use of this alloy.

the warped intermediate shaft gear for a 3¾-yd. electric shovel.

18-3. Steel Casehardening Process Speeds Production. Arthur Q. Smith. *Industrial Gas,* v. 25, Dec. 1946, p. 20, 22, 34.

Chapmanizing process involves addition of nitrogen to iron-base alloys by heating the metal in presence of a nitrogenous material. The case is extremely hard but sufficiently ductile. Equipment required.

18-4. Le Recuit de La Malleable a Coeur Blanc Par un Melange Gazeux. (Decarburization of White Cast Iron by Means of Gaseous Mixtures.) Gabriel Joly. *Fonderie,* Oct. 9, 1946, p. 335-343.

Necessity of using electric and gas furnaces with controlled atmospheres, since use of such furnaces decreases expenses considerably and results in a higher quality and more uniform product.

18-5. Gaseous Annealing of White-Heart Malleable Castings. P. F. Hancock. *Foundry Trade Journal,* v. 80, Nov. 28, 1946, p. 309-316.

At present, malleable castings are annealed while packed in iron ore in heavy cans. New process described makes it possible to eliminate cans and ore, reduces time of process from several days to 20 to 30 hr. Over-all operating costs are greatly reduced and working conditions are improved.

18-6. Some Investigations on the Heat Treatment of Sheet Steel for Cold Pressing. (Continued.) J. Yourtaieff. *Sheet Metal Industries,* v. 23, Dec. 1946, p. 2329-2334.

Structural and mechanical property changes taking place in cold worked sheets from killed steel in the course of annealing at different temperatures. Pieces reduced less than 20% should be normalized (annealed at 925° C.) if they are to be subjected to repeated shocks or alternating stresses; pieces reduced more than 20% may be annealed at lower temperatures regardless of ultimate service. Begins discussion of low-temperature annealing. (To be concluded.)

18-7. Continuous Strip Annealing. E. J. Seabold. *Iron and Steel Engineer,* v. 23, Dec. 1946, p. 74-83; discussion, p. 83-86.

Furnace design for strip annealing with an improved cycle of heat treatment and with thermal efficiency increased by heat exchange between strip leaving the furnace and the entering strip. The design and operation of the furnace and the annealing process shown by means of detail drawings. Setup used to check the temperature of any part of the cycle. Processing costs are calculated. Advantages are: speed of processing, no increase in costs over batch methods, and combination of cleaning with annealing.

18-8. Production Carburizing. Lester F. Spencer. *Steel Processing,* v. 32, Dec. 1946, p. 797-808.

Carburizing procedures; methods of carburization; pack carburizing; protection from carburization. (To be continued.)

18-9. Contribution a la Connaissance des Alliages Al-Zn-Mg-Cu-Cr. (Contribution to the Study of Al-Zn-Mg-Cu-Cr Alloys.) *Comptes Rendus,* v. 223, Nov. 4, 1946, p. 727-729.

A series of test specimens of alloys containing 8.5% Zn, 1.5% Cu, 2.5% Mg, 0.25% Cr, 0.07% Fe, 0.03% Si, balance Al, has been investigated by means of X-rays to determine the dependence of their strength properties on the quench temperature.

18-10. Potential Hazards in Molten Salt Baths for Heat Treatment of Metals. *The National Board of Fire Underwriters Research Report* no. 2, 1946, 40 p.

The molten salt bath method of heat treatment; typical accidents and their causes; recommended precautions.

18-11. Induction Hardening of Steel. D. L. Martin and R. A. Gehr. *Steel,* v. 120, Jan. 13, 1947, p. 78-81, 114-115.

Factors determining successful use of induction hardening, problems that arise, and importance of generator power output on the heating rate of steel parts.

18-12. Isothermal Heat Treatment of Tools. E. F. Watson. *Machinery (London),* v. 69, Dec. 5, 1946, p. 729-730.

Effects produced by quenching; controlling change of structure; the isothermal process.

18-13. Automatic Continuous Heat Treatment. *Iron Age,* v. 159, Jan. 16, 1947, p. 63.

Savings in space, time, labor, and fuel, with uniformity of product treatment were realized in a recent installation in a drop forging plant for automatic continuous heating, quenching, washing and drawing of assorted steel forgings.

18-14. Subzero Treatment of Steels. G. H. Jackson. *Aircraft Production,* v. 8, Dec. 1946, p. 588-593.

Metallographic principles involved in high speed steels and high-alloy steels. Indicates that insufficient practical work has been carried out to substantiate claims of improved life in toolsteels, but that the use of low temperatures for alloy steels such as S.82 should be favorably considered by reason of the fact that dimensional stability, freedom from stress and increased hardness values of intricate shapes can be secured. 10 ref.

18-15. Induction Hardening of Steel. Part II. D. L. Martin and R. A. Gehr. *Steel,* v. 120, Jan. 20, 1947, p. 74-78.

Items to be considered such as coil design and quenching fixtures. (To be continued.)

18-16. Modern Heat Treating Methods in an Automobile Plant. Charles H. Wick. *Machinery,* v. 53, Jan. 1947, p. 141-149.

In the Buick Motor Division of G.M. all of the Buick motor and differential parts are heat treated in a central area which occupies 47,000 sq.ft. of factory floor space. Normalizing, carburizing, hardening, and tempering operations are performed in 64 heat treating furnaces having capacities of 400 to 4000 lb. per hr. Furnaces range from relatively small batch-type tempering furnaces, 20 in. in diameter x 36 in. deep, to hardening furnaces having a hearth area 4 ft. wide x 33 ft. long and a height from hearth to arch of 30 in.

18-17. Bits and Pieces. *Metal Progress,* v. 51, Jan. 1947, p. 85-87.

Brief items include: "Size Stabilization" by Avery C. Jones (treatment of parts at −150° F. accelerated the austenite→martensite transformation, thus stabilizing dimensions); "To Avoid Staining Around Cracks" by Victor Kappel (technique prevents acid staining of macrograph specimens); "Hot Hardness Testing" by Otto Zmeskal (simplification of Rockwell hardness units for routine work); "Identification of Nickel or Monel Wire in a Woven Wire Screen" by Robert L. Hackney (nondestructive chemical test); and "Etching Reagent for Stainless Steel" by Robert A. Huseby (aqua regia saturated with $CuCl_2$).

18-18. Cooling Rates of Plates and Rounds. A. L. Boegehold and E. W. Weinman. *Metal Progress,* v. 51, Jan. 1947, p. 96-B.

Data sheet shows revised average cooling rates at various positions on Jominy end-quenched specimens made of 1045, 9420 and 9445 steel, compared with values given on S.A.E. standard chart; correlation of cooling rates and times between Jominy bar and plates and bars of various diameters. (Taken from O.S.R.D. report on "Heat Treatment of National Emergency Steels for Use in Tanks, Combat Cars, Gun Mounts and Other Ordnance Materiel".)

For additional annotations indexed in other sections, see:
3-14-15-23; **16**-2-7-8-10; **22**-48; **27**-15-19.

19 WORKING—Rolling, Drawing, Forging

19-1. Stretch Principle Employed in the Manufacturing of Seamless Tube. *Blast Furnace and Steel Plant,* v. 34, Dec. 1946, p. 1531-1532.

Application of this principle not only permits substantial reduction of wall thickness of the tube but also provides a means for making exceptionally large diameter reductions with relatively few roll passes.

19-2. Thread Rolling—Theory and Practice. Part II. J. W. Batchelder. *Iron Age,* v. 158, Dec. 26, 1946, p. 55-61.

Various stresses imposed on thread rolling dies analyzed; how they may be minimized or counteracted. Comparative testing for quantitative die life; points to be observed in the selection of materials for the manufacture of die sets. Merits of grinding to produce die threads; strength of die materials; use of carbide dies.

19-3. Predetermination of Pulling Force in Drawing Steel. W. Lueg and A. Pomp. *Materials & Methods,* v. 24, Dec. 1946, p. 1536.

Series of tests was made with carbon-chromium, 18-8 and chromium-vanadium steels in order to find a simple method to predetermine the pulling force; the drawing die had an opening of 17 mm. and an entry angle of 20°. Tests permitted the establishment of the required pulling force equation. (Condensed from *Mitteilungen aus dem Kaiser-Wilhelm Institut fur Eisenforschung zu Dusseldorf,* v. 27, 1944, p. 43-52.)

19-4. John Summers & Sons Expansion Program. *British Steelmaker,* v. 12, Dec. 1946, p. 590-595.

New developments in British sheet steel mill, including a new 80-in. reversing strip mill.

19-5. Variable Voltage Drives for Blooming Mill Tables and Feed Rolls. Z. W. Whitehouse and A. F. Kenyon. *Steel,* v. 119, Dec. 30, 1946, p. 92-94, 96.

Separate generators have "shovel" characteristics which provide a high running speed for tables and feed rolls and afford protection against overloading. Provision is made for necessary repairs and maintenance.

19-6. The Rolling of Metals: Theory and Experiment. Part XIII. L. R. Underwood. *Sheet Metal Industries,* v. 23, Dec. 1946, p. 2319-2328, 2336.

Torque, deformation work and rolling horsepower. (To be continued.)

19-7. Practical Problems of Light Presswork Production. Deep Drawing. (Continued.) J. A. Grainger. *Sheet Metal Industries,* v. 23, Dec. 1946, p. 2341-2349.

Workhardening and strain hardening; formation of stress cracks during or after cold working; use of normalizing to avoid this trouble. Possible causes of "stretcher-strain" markings; proper techniques for press-tool setting. Details of the pressing equipment including hydraulic and pneumatic cushions and systems, charging the system with oil, and the operating cycle. (To be continued.)

19-8. Some Drawing Operations on Sheet Metal. H. W. Swift. *Sheet Metal Industries,* v. 23, Dec. 1946, p. 2365-2376, 2384.

Superficial account of a few typical press operations in order to show something of the methods adopted by industry and the resources and ingenuity of the press engineer. Investigations at University of Sheffield.

(Turn to page 34)

New A.S.M. Chapter Formed in Canada

H. J. Wright
Chairman

F. G. Floyd
Vice-Chairman

J. Roy Toll
Secretary

R. E. Barton
Treasurer

A new chapter of the American Society for Metals has been organized with headquarters in London, Ont., Canada. The new group, to be known as the Western Ontario Chapter, will bring to 71 the total of A.S.M. local sections throughout the United States and Canada.

An organization meeting of charter members was held in December, at which temporary officers were elected:

CHAIRMAN — Howard J. Wright, Federal Foundries & Steel Co., Ltd.

VICE-CHAIRMAN — Frank G. Floyd, Kelvinator of Canada, Ltd.

SECRETARY — J. Roy Toll, Webster Air Equipment, Ltd.

TREASURER — Ray E. Barton, Canadian Mines Equipment Co., Ltd.

At the organization meeting a petition was assembled and submitted to the Board of Trustees, which granted the chapter a charter in accordance with the regulations of the society's constitution. The charter was presented at the first formal meeting of the chapter on Jan. 31.

7 Million Chain Parts Heat Treated Daily

Reported by R. B. Miclot
Lunex Co.

In an illustrated talk on "The Manufacture and Metallurgy of Roller Chain", A. E. Focke, ⊕ trustee and chief metallurgist for the Diamond Chain Co., Inc., of Indianapolis, described and explained the methods of processing and assembling the parts of which roller chain is composed. Dr. Focke addressed the December session of the Tri-City Chapter.

These parts are pins, rollers, bushings and link plates. Dr. Focke discussed the metallurgical and mechanical aspects of tension and wear involved in producing and applying roller chain. Many of the metallurgical problems in the production of roller chain, he said, result from the necessity of handling a multiplicity of small parts. For example, in order to meet Diamond Chain's present production schedule, it is necessary to process over seven million chain parts through the heat treating department every day.

Compliments

To CYRIL STANLEY SMITH on his appointment as a member of the Board of Scientific Consultants to the Atomic Energy Commission recently set up by President Truman. Mr. Smith, who will be the only metallurgist on the board, is now head of the Institute of Metals of the University of Chicago; he was formerly joint head, with J. W. Kennedy, of the chemistry and metallurgy division of the Los Alamos Laboratory, which formulated the atomic bomb.

To MATTHEW J. DONACHIE ⊕, technical director of production, Beryllium Corp., Reading, Pa., on the award of the 1945 Wire Association Medal for his paper entitled "Some Traits and Characteristics in the Working of Beryllium-Copper Wire"; also to RALPH C. ELLAMS, supervisor, electrical coating development, Roxalin Flexible Finishes, on the award of a certificate of honorable mention.

To H. H. BLOSJO ⊕ and E. C. TROY ⊕ on their appointments to the chairmanship and vice-chairmanship, respectively, of the 1946-47 Steel Division Program and Papers Committee of the American Foundrymen's Association. Mr. Blosjo is metallurgist of the Minneapolis Electric Steel Castings Co., and Mr. Troy is metallurgist of the Dodge Steel Co., Philadelphia.

To JAMES T. MACKENZIE ⊕, chief metallurgist, American Cast Iron Pipe Co., on his selection to deliver the 1947 Charles Edgar Hoyt Annual Lecture at the American Foundrymen's Association convention. This is the first in a new lecture series established to honor Mr. Hoyt. Dr. MacKenzie has selected "The Cupola Furnace" as his subject.

To WILLIAM J. REAGAN ⊕, associate professor of metallurgy, Pennsylvania State College, on his election as chairman of the Electric Furnace Steel Committee, American Institute of Mining and Metallurgical Engineers.

19-9. New Technique in Drawing and Embossing Sheet Metal. P. D. Aird. *Modern Industrial Press,* v. 8, Dec. 1946, p. 13-14, 16.

Stampings are set with a fluid punch which exerts a steady, uniform pressure on every part of the blank. This makes possible the formation of involved contours and exceptional draws. Two methods: stretch forming and drawing.

19-10. Modern Press Line Enables Utility Appliance Corp. to Establish Enviable Production Record. Clyde Crossman. *Modern Industrial Press,* v. 8, Dec. 1946, p. 24, 26.

Sequence of operations required to make shroud rings from 12-gage heat resistant steel sheet.

19-11. "Can You Draw Aluminum?" Part II. E. V. Sharpnack. *Modern Industrial Press,* v. 8, Dec. 1946, p. 30, 32, 34, 40.

Some of the more unfamiliar "know-how" factors, including the type of steel and recommended dimensions for the tools, and proper lubrication.

19-12. Specialized Pipe Bending. M. G. Hawkins. *Modern Industrial Press,* v. 8, Dec. 1946, p. 38, 40.

Special bends of pipe are made by various hand, semimanual and electrically powered methods at Olympic Pipe Fabricating Co.

19-13. Light Alloy Extrusion. *Metal Industry,* v. 69, Dec. 13, 1946, p. 485-487.

Production of sections for the aluminum house. Production planning, pyrometry, laboratory setup, die design and assembly, billet preheating. (To be concluded.)

19-14. New 56-In. Continuous Hot Strip Mill, The Steel Company of Canada, Ltd. C. J. Porter. *Iron and Steel Engineer,* v. 23, Dec. 1946, p. 55-60.

New continuous hot strip mill and its auxiliary equipment.

19-15. Trends in Electrical Equipment for Steel Mills. G. E. Stoltz. *Iron and Steel Engineer,* v. 23, Dec. 1946, p. 61-66; discussion, p. 66-69.

Some of the developments in electrifying the steel industry since 1900 and possible future progress.

19-16. Cold Finished Bar Steel. Thomas D. Taylor. *Iron and Steel Engineer,* v. 23, Dec. 1946, p. 70-73.

Development of new types of steel for cold finished bars, and new methods to process these materials.

19-17. Roll Design for Die Rolling. Thomas N. Sloan. *Iron and Steel Engineer,* v. 23, Dec. 1946, p. 87-90; discussion, p. 91-92.

Rules for design of the rolls, and techniques used by Republic Steel for production of parts as complicated as crankshafts by die rolling.

19-18. A Tooling Program for Forged Globe Valves. Part II. Carl F. Benner. *Tool & Die Journal,* v. 12, Dec. 1946, p. 92-97.

Forging dies; the forging operation; trimming dies. (To be continued.)

19-19. Aluminum Shingles Produced on Tilted Presses. *American Machinist,* v. 91, Jan. 2, 1947, p. 95.

Standard presses, bolted to angle-iron supports anchored to the floor, are tilted to provide gravity unloading for flanging, crimping and trimming operations on the shingles.

19-20. Rolling of Screw Threads. H. Dinner and W. Felix. *Fasteners,* v. 3, no. 5, 1946, p. 10-11.

Results of tests made to establish the characteristics of rolled threads under static as well as dynamic stress. Microstructures of machined and of rolled threads are shown. It was found that static tensile and bending strengths of rolled and of machined threads are practically identical. But in the case of dynamic loading a rolled thread has greater fatigue strength and is not subject to aging. (From *Technische Rundschau Sulzer,* no. 1, 1945, p. 131-134.)

19-21. Ingot Factors in the Production of Heavy-Walled Seamless Tubes. K. L. Fetters. *Industrial Heating,* v. 13, Dec. 1946, p. 1996-1998.

Problems involved in the manufacture of heavy-walled seamless tubes were the high rate of rejection for bore defects (internal ruptures) appearing in the machined bores, and cracking in water quenching.

19-22. The Modern Forging Operation. J. A. Over. *Steel Processing,* v. 32, Dec. 1946, p. 795-796, 805-806.

Basic considerations of hammer forging of steel.

19-23. Shell Forging Press. *Iron and Steel,* v. 19, Dec. 1946, p. 809-811.

German use of new "Eumuco" design, a vertical type of press with self-contained motor drive arranged for combined piercing and drawing operations.

19-24. German Shell Steel. *Iron and Steel,* v. 19, Dec. 1946, p. 811-812.

Casting and forging procedures in general use.

19-25. Light Alloy Extrusion. (Concluded.) *Metal Industry,* v. 69, Dec. 20, 1946, p. 509-511.

Production of sections for the aluminum house.

19-26. The Production of Aluminum Hollow Ware. *Machinery (London),* v. 69, Dec. 5, 1946, p. 715-720.

Drop stamping methods at the works of Faulkners, Ltd.

19-27. Dies for Drop Stamps. *Foundry Trade Journal,* v. 80, Dec. 5, 1946, p. 345-346.

Process for making dies from the drop stamp entailing: construction of a master form in wood or plaster; casting from the master form a pattern in plaster of the lower or female die; making a sand mold from the plaster pattern and pouring zinc alloy into the mold to form the lower die; and using the lower die as a mold to produce the top die or punch, by pouring antimonial lead into the zinc mold. (Extracted from a bulletin published by the Aluminium Development Association, "The Formation of Aluminum and Its Alloys by the Drop Stamp.")

19-28. Thread Rolling—Theory and Practice. Part III. J. W. Batchelder. *Iron Age,* v. 159, Jan. 9, 1947, p. 52-57.

Methods of finishing thread-rolling dies by grinding, lapping, and abrasive blasting. Information is also presented on testing various types of steel, setting up the dies, and inspecting dies and threads by means of an optical comparator.

19-29. Influence of Shot-Peening on Fatigue Strength of 14S-T Alloy. C. B. Gleason. *Iron Age,* v. 159, Jan. 9, 1947, p. 62-64.

Results of an investigation to determine the effect of shot-peening on the fatigue strength of 14S-T aluminum alloy. Tests on unnotched specimens indicated possibility of increases in life of as much as 80 times that of unpeened material, while notched specimens showed more than 32% improvement in fatigue strength.

19-30. An Electronic Aid in Die Making. *Tool & Die Journal,* v. 12, Jan. 1947, p. 77-80.

Contour following signal device and an electroconductive coating, termed "Signa-Kote", that is applied to the nonconducting surface of a master mold or pattern used in combination on those types of duplicating jobs where heretofore the old stand-by tin foil method was common practice. Tin foil technique and its shortcomings.

19-31. Small Precision Cold Strip Mill. *Iron Age,* v. 159, Jan. 16, 1947, p. 49-50.

Small self-contained Sendzimir precision cold strip mills capable of gage accuracies up to 0.0001 in. are said to be especially suitable for rolling thin strip down to foil gages in highly work hardening alloys.

19-32. Cold Strip Reduced in One Pass at 400 Feet Per Minute. *Steel,* v. 120, Jan. 20, 1947, p. 80.

Cold strip 0.10 to 0.125 in. thick by 36 in. wide is reduced in one pass by a cold reduction mill. Capacity is nearly 60 tons of tinplate per hr.

19-33. Tube Production by Stretch Method. *Production Engineering & Management,* v. 19, Jan. 1947, p. 59.

Process as it will be applied in world's first continuous seamless tube mill at National Tube Co.

19-34. Roll Bending and Flash Welding Stainless Steel Turbosupercharger Rings. P. B. Scharf. *Iron Age,* v. 159, Jan. 23, 1947, p. 52-56.

Process consists of roll bending or forming plate or bar into a circle of the diameter and curvature desired in the finished ring. The formed sections are then butt-flash welded together to form a continuous ring. The welding operation is followed by one or more sizing or stretching operations which insure diameter, roundness and flatness. Accuracy within close tolerance is assured. Octagonal shapes or nonuniformly shaped sections may be made by same general process.

For additional annotations indexed in other sections, see:
7-4; **13**-2; **14**-6; **16**-2-9; **18**-6-7; **20**-33; **21**-1; **23**-19; **24**-8-14; **27**-1-26.

20 MACHINING AND MACHINE TOOLS

20-1. Machine and Tool Engineering. *Production Engineering & Management,* v. 18, Dec. 1946, p. 58-59.

"Combination Tool Solves Turret Lathe Problems" by R. E. Cameron; "Inverted Drilling Method Includes Chip Removal" by Robert Mawson; "Nibbling Machine Cuts Tubes to Irregular Contours" by Alexander Coulter.

20-2. New Cutting Speeds for Brass Offset Higher Material Costs. Russell A. LaCombe. *Production Engineering & Management,* v. 18, Dec. 1946, p. 60-61.

New standards of operation have resulted from the successful application of feeds and speeds far in excess of those ordinarily employed for production machining of brass.

20-3. The Removal of Metals by Grinding. R. E. McKee, R. S. Moore, and O. W. Boston. *Society of Automotive Engineers Preprint,* 1946, 11 p.

Results of an investigation to determine the influence of grinding wheels, grinding compounds, and other pertinent factors that may affect the process of cylindrical grinding. Machine used was a Cincinnati No. 2 cylindrical grinder with a 10-in. swing and 36 in. between centers. S.A.E. 52100 steel, a product of an electric furnace, was used. Measuring equipment used during the tests.

20-4. High-Speed and Superspeed Cutting of Metals. I. M. Besprozvany, A. N. Danielian, A. V. Pankin, and N. I. Reznikov. *Engineers' Digest,* v. 3, Nov. 1946, p. 565-567.

Various attempts to utilize "superspeed" in metal cutting and machining operations and the difficulties encountered. Authors conclude that speeds of several thousand feet per min. are not practicable, except for aluminum. However, a threefold increase in speed is theoretically justified by the high-speed alloys. Twenty practical details of superspeed end and face milling of steel. New machines with triple present horsepower, greatly increased strength and rigidity, precise balancing, and a flywheel should be designed for superspeed milling. (Con-

(Turn to page 36)

Father and Son Officiate at Chapter Silver Anniversary

Reported by H. E. Habecker
Mattison Machine Works

Charter members and chapter chairmen were honored at the silver anniversary meeting of the Rockford Chapter ⊕ on Dec. 11. Present were National President A. L. Boegehold and Secretary W. H. Eisenman. Otto T. Muehlemeyer, first chairman of the chapter (whose son, Carl, is present chairman), was given a wrist watch in recognition of his efforts, loyalty and interest in the success of the organization.

National Secretary Eisenman, who had also been present at the first meeting of the group just 25 years ago, on Dec. 12, 1921, presented a short history of the national organization, and pointed out its great progress from a small group of only a few chapters to its present 20,000 members and 71 chapters.

Other chairmen honored were Swan Hillman, R. M. Smith, Leo J. Strohmeyer, Freeman Anderson, James J. Burns, Joseph Harris, Wilhelm Olson, Ural Gillett, who were present; and Chester B. Sadtler and Lawrence Foote, unable to attend. Deceased are Charles Cotta and Clarence Crain.

Rockford Officers—Past and Present

President Boegehold and Secretary Eisenman Are Flanked on Either Side by Two Generations of Chapter Officers in This Father-and-Son Photograph. Back row at left is Otto Muehlemeyer, first chairman of the Rockford Chapter 25 years ago; center, Mr. Boegehold; and right, Carl Muehlemeyer, Otto's son and current chairman. Seated in front are the secretaries: R. M. Smith (left), first secretary of the chapter in 1921 (and also a later past chairman); National Secretary Eisenman; and H. E. Habecker, current secretary

densed from *Vestnik Inzhenerov i Tehnikov*, no. 2, 1946, p. 65-73.)

20-5. Behind the Steel Curtain. Ralph M. Smith. *American Machinist*, v. 91, Jan. 2, 1947, p. 73.

An effective and satisfactory guard, developed for use in Carboloy Co.'s machine shops, consists of a large ring from which are suspended overlapping lengths of steel sash chain. This guard is particularly adapted for use on vertical milling machines. Various design modifications in location of mounting brackets and adjustability of guard position have been made to permit its use with vertical millers of different makes, types and sizes.

20-6. Interchangeability of Large Machine Parts. N. N. Sawin. *American Machinist*, v. 91, Jan. 2, 1947, p. 88-91.

Results of foreign research on diameters from 500 to 3,000 mm.

20-7. Blind Holes Splined With Short-Section Broaches. Harry H. Gotberg. *American Machinist*, v. 91, Jan. 2, 1947, p. 99.

Design of broach for a specific problem.

20-8. Practical Ideas. *American Machinist*, v. 91, Jan. 2, 1947, p. 101-108.

Direct-reading straightedge tester uses three toolmakers' buttons. Tighter grip improves pivoted joints. Serrated cam clamps light castings in multiple drill jig. Electric stops indicate proper depth of cut. Make grinding goggles impossible to ignore. How to position a slotting cutter. Torsional V-gage. Stepped cylinder. V-block adapter. Pendulum gage. Hooded surface grinders remove abrasive dust. How to utilize broken taper-shank drills. Pillar files knurl stainless steel rods. Die-head improvements solve small-thread problems. Screw feed improves grooving and boring head. Air blast removes paper from steel strip roll. Die square.

20-9. Boring Machine With Planer-Type Table. *Engineering*, v. 162, Nov. 29, 1946, p. 511-512, 516.

Description of boring mill, special applications, operation.

20-10. The Machining of Stainless Steels. W. H. Crisp. *Engineering*, v. 162, Nov. 29, 1946, p. 526-528.

Recommendations for the production of holes and threads.

20-11. The Broaching of Brasses and Bronzes. Part II. Harry H. Gotberg. *Tool & Die Journal*, v. 12, Dec. 1946, p. 85-88, 100, 102.

Handling of broaches; broaching machines; machine setup; fixtures; machine operation; broach sharpening.

20-12. Safe Feeds and Speeds for High Speed Drills. *Tool & Die Journal*, v. 12, Dec. 1946, p. 119.

Speeds and feeds applying to average working conditions of cast iron; bronze or brass; drop forgings of alloy toolsteel, annealed; drop forgings of alloy steel, heat treated; steel castings; mild steel.

20-13. Broaching Machines, Tools and Practice. (Concluded.) E. Percy Edwards. *Engineering*, v. 162, Dec. 6, 1946, p. 534-535.

Construction of broaching machines; types and forms of broaches; design of broach bars; materials for broaches; coolants; sharpening; fixture design.

20-14. Groove and Slot Grinding. *Industrial Diamond Review*, v. 6, Dec. 1946, p. 362.

Information concerning the above operations. (Abstracted from *Grits & Grinds*, v. 36, no. 6, 1945, p. 8-10.)

20-15. Economic Use of Diamond Abrasive Sawing Disks. *Industrial Diamond Review*, v. 6, Dec. 1946, p. 366.

Information is tabulated.

20-16. Diamond Wheel Dressing on the New Gleason Hypoid Grinder. *Industrial Diamond Review*, v. 6, Dec. 1946, p. 371-372.

New automatic machine for grinding spiral, hypoid and Zerol bevel gears by the generating method.

20-17. Limitation of Sintered Carbide. R. B. Sheffer. *Industrial Diamond Review*, v. 6, Dec. 1946, p. 372.

Author debunks "misconceptions" concerning nonapplicability of sintered carbide tools for certain uses.

20-18. Centerless Taper Grinding by Swivelling Regulating Wheel. *Industrial Diamond Review*, v. 6, Dec. 1946, p. 379.

Improved method is described.

20-19. Grinding Machine for Table-Knife Shoulders. *Engineering*, v. 162, Dec. 13, 1946, p. 561.

British machine manufactured by Messrs. A. A. Jones and Shipman, Ltd., is applicable to single specific purpose.

20-20. Precision Finishing of Bores. E. R. Yarham. *Modern Machine Shop*, v. 19, Jan. 1947, p. 124-130.

British methods of boring and honing holes in aircraft components where a high finish and close limits on size are specified.

20-21. Necessities of War Increase Production for Peace. E. A. Zaczek. *Modern Machine Shop*, v. 19, Jan. 1947, p. 146-148, 150, 154, 156, 158, 160, 162, 164, 166, 168, 170.

Machine tools that did the work of as many as three former pieces of equipment and which in two cases increased the output 400% were developed and coordinated into a production system specifically designed to meet rigid delivery schedules. New machines are chiefly in the fields of milling, drilling, and tapping operations. Each tool fully described, showing how it increases production.

20-22. Ideas From Readers. *Modern Machine Shop*, v. 19, Jan. 1947, p. 202-204, 206, 208, 210, 212, 214, 216, 218.

A simple but useful sine bar. Automatic milling fixture. Adjustable facing cutter. Vise attachment which facilitates templet filing.

20-23. Centerless Grinding Operations on Fountain Pen Components. *Machinery (London)*, v. 69, Dec. 12, 1946, p. 754-755.

Process used for grinding barrels, caps, and pen sections. Limitations of the process.

20-24. Toolmaking Methods. *Machinery (London)*, v. 69, Dec. 12, 1946, p. 747-753.

Typical problems encountered in high precision work and their practical solution, with particular reference to concentricity and thread gages.

20-25. Special Techniques for Precision-Made Products. *Western Machinery and Steel World*, v. 37, Dec. 1946, p. 94-100.

Plant and equipment and operations for the production of the Kirsten "radiator" pipe and the Kirsten cigarette holder. Begins with working with the base metal—duralumin—in the form of extruded bars.

20-26. Pumps Are Machined Products. R. G. Paul. *Western Machinery and Steel World*, v. 37, Dec. 1946, p. 102-105.

Essential parts of this pump for the petroleum industry are fabricated from gray iron castings. These are the pump housing, the cover, the three elements of the rotor, the stub cap, the stuffing box and the relief valve housing. Machining and assembly operations.

20-27. Tool Life and the Selection of Carbide. Raymond O. Catland. *Western Machinery and Steel World*, v. 37, Dec. 1947, p. 108-111.

Design of milling cutters. (To be continued.)

20-28. Precision Machining of Wrought Aluminum Alloys. Gilbert C. Close. *Light Metal Age*, v. 4, Dec. 1946, p. 18-22.

The metallurgical characteristics of the wrought alloys which have a bearing on machinability. Specific recommendations for milling, drilling, reaming, threading and tapping, sawing, and filing.

20-29. Unique Tooling Used to Mass Produce Special Parts at G. M. C. Saginaw Steering Plants. Joseph Geschelin. *Automotive and Aviation Industries*, v. 96, Jan. 1, 1947, p. 24-29, 74.

Methods and equipment in producing steering gears, steering gear linkages, propeller shaft assemblies, universal joints, transmission parts, precision bushings for front end suspensions, cam followers, valve guides and pumps for diesel engines, and other specialized items.

20-30. Machinability of Metals. Georg Schlesinger. *Tool Engineer*, v. 17, Jan. 1947, p. 18-27.

Various problems involved in metal cutting. Attempts to strike an average from the enormous variety of possibilities and to derive therefrom practical and generally applicable rules that will be readily understandable to production executives and foremen as well as to operators and inspectors.

20-31. Roll Crushing Plus Diamond Dressing. *Tool Engineer*, v. 17, Jan. 1947, p. 27.

Dual-function wheel dresser consists of a high-precision pantograph, working directly from a templet plus a power-driven roll crusher, both mounted together and accurately related to the spindle. Combination results in a precision and economy in form grinding not achieved by either method alone or by both as independent units.

20-32. Removing Stub Shaft. *Tool Engineer*, v. 17, Jan. 1947, p. 47.

Methods involve use of gunpowder and grease or oil.

20-33. A Tooling Program for Forged Globe Valves. Part III. Carl F. Benner. *Tool & Die Journal*, v. 12, Jan. 1947, p. 72-76.

Six views of the forged brass offset valve body showing the various steps in the machining program. Discusses each operation. (To be continued.)

20-34. Jig Drills Reduce Capital Outlay, Eliminate Setup Time. E. Prange. *Iron Age*, v. 159, Jan. 9, 1947, p. 42-45.

Method of combining small standard drill heads with the drill jigs. These inexpensive units are ideal for relatively light work, and in addition to requiring a very much smaller capital outlay, eliminate the setup time formerly required.

20-35. Wet Belt Machining. Harvey L. Ramsay. *Machine and Tool Blue Book*, v. 43, Jan. 1947, p. 133-141.

Advantages, applications, and benefits to be gained from using the abrasive-belt machining method. Underlying principles, platens, belts, coolants, and automatic feed table, as well as the new centerless abrasive grinder.

20-36. How to Grind Carbide Tools. Part I. H. A. Frommelt. *Machine and Tool Blue Book*, v. 43, Jan. 1947, p. 143-144, 146, 148, 150-152, 154, 156, 158, 160.

The grinding of single point carbides.

20-37. Machining With File Bands. H. J. Chamberland. *Machine and Tool Blue* Book, v. 43, Jan. 1947, p. 162-164, 166-168, 170-171.

Types of filing bands, special uses, sizes. Tests report on the cutting time of band files and the amount of stock removed, and compare findings to previously used methods.

20-38. Broaching. E. Percy Edwards. *Aircraft Production*, v. 8, Dec. 1946, p. 570-573.

Review of tool designs and practice; cutting speeds; coolant; broach maintenance; resharpening.

20-39. Reducing Processing Costs by Functional Hone Abrading. K. W. Connor and L. S. Martz. *Iron Age*, v. 159, Jan. 16, 1947, p. 54-58.

As a result of several new developments in the honing field, it is possible to remove 25 to 30 times as much stock at rates 10 to 12 times faster than was formerly considered practicable. Stone life has been increased

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Smith's Ideas on Atomic Control Rouse Discussion

Reported by W. O. Longnecker
Bethlehem Steel Co.

Cyril Stanley Smith, professor of metallurgy and director of the Institute for the Study of Metals, University of Chicago, discussed the present and possible future developments of nuclear energy before approximately 350 members and guests of the Lehigh Valley Chapter and the Engineers' Club of the Lehigh Valley on Dec. 6.

Dr. Smith began by outlining the physical principles of the release of energy by atomic fission, but paid particular attention to the part played by engineers and metallurgists in making possible the realization of the plans of the physicists. Chemists developed methods of studying the reactions of entirely new elements using almost invisible amounts and were sure enough of their results to design huge production equipment without waiting for pilot-plant operation.

The reduction and fabrication of uranium involved extremely interesting metallurgical studies and one of the most critical problems was the prevention of corrosion of uranium in the hot cooling water of the plutonium-producing piles. Fabrication of the plutonium and uranium (U^{235}) parts for the bomb was a fascinating job because it involved the study of entirely new metals whose properties and metallurgy had to be developed on minute amounts before production commenced; it was hazardous laboratory work because of the toxicity of plutonium even in microgram amounts.

The generation of useful power from nuclear reactors will require less development in physics than in general engineering and metallurgy, and will utilize experience of the steam and gas turbine designer. Materials are needed capable of withstanding stress at high temperatures, and for some parts withstanding enormously high levels of radiation without damage and without excessive absorbtion of the neutrons. A useful byproduct of the power plants will be radioactive forms of almost any desired element, useful for research on innumerable chemical and metallurgical reactions as well as for chemical analysis, and potentially for automatic control of industrial processes.

Economic and social aspects of the new force were mentioned briefly, and a keen discussion of this phase followed the talk. Dr. Smith said that some form of international control is essential and he believes the Baruch proposals to the United Nations to be workable. This plan is particularly commendable because of its constructive approach, international cooperation of scientists and engineers in joint enterprise being relied upon to a greater extent than purely negative snooping. The U. S. is bound to lose its present monopoly, and the Baruch plan sees to it that information on successive stages is divulged only when adequate safeguards against misuse have been established.

Left to Right Are A. O. Crobaugh, Chairman of the Lehigh Valley Chapter; George A. Barker, Secretary; W. M. Stanton; and Cyril Stanley Smith, Who Addressed the Group on "Nuclear Energy"

There is danger that people will become forgetful; it is most important that engineers and scientists keep their fellows continually aware of the extreme importance of the problem, and that they help to build up public knowledge and demand for the proper legislative and international action.

The technical meetings committee of the Engineers' Club of the Lehigh Valley and the program committee of the A. S. M., both under the chairmanship of J. B. Godshall of Ingersoll Rand Co., arranged for the joint meeting.

as much as 1500% and bore size can be held uniformly and automatically within 0.0003 in.

20-40. Engineering Short Cuts for Screw Machine Departments. C. W. Hinman. *Screw Machine Engineering,* v. 8, Jan. 1947, p. 30-33.

Formulas having an everyday application in the engineering of a screw machine product, tool designing, or operation of automatic screw machine, chucking machine and turret lathe.

20-41. Review Your Tooling Techniques. *Screw Machine Engineering,* v. 8, Jan. 1947, p. 35-37.

Exceptionally well tooled Davenport automatic screw machine setup illustrates many screw machine fundamentals which can be applied daily.

20-42. Use Automatics to Full Capacity. *Screw Machine Engineering,* v. 8, Jan. 1947, p. 49-51.

Capacity of automatic; correct sequence of operations and tooling; knurling; deep hole drilling. Marked advantages of using an automatic with a faster spindle speed.

20-43. Designing Tools for Screw Machine Production. *Screw Machine Engineering,* v. 8, Jan. 1947, p. 53-55.

Three applications of combination tooling.

20-44. Lowering Grinding Wheel Maintenance Costs. Russell A. La Combe. *Production Engineering & Management,* v. 19, Jan. 1947, p. 51-54.

Careful handling and proper storage methods virtually eliminate pre-use losses of grinding wheels.

20-45. Time-Saving Techniques With Friction Sawing. H. J. Chamberland. *Production Engineering & Management,* v. 19, Jan. 1947, p. 55-59.

Cutting speeds, production rates and saw specifications resulting from recent tests of process.

20-46. Production Possibilities With Light Machine Tools. P. S. Hoddeson. *Production Engineering & Management,* v. 19, Jan. 947, p. 76-78.

Postwar installations which have been developed with light machine tools in recent months.

20-47. Portable Milling Machine Decreases "Down Time" of Generators. *Machinery,* v. 53, Jan. 1947, p. 155-156.

Has longitudinal feed of 60 in. and is capable of taking cuts ¼ in. deep in cast iron. Is estimated that machine has saved one-third the time and costs required when using two smaller, conventional-type, portable milling machines. Machine consists of a motor-driven spindle, secured to a carriage that can be automatically fed transversely in a saddle. The saddle, in turn, with spindle and carriage, can be fed longitudinally on the bed of the machine.

20-48. New Aluminum Oxide Abrasive Improves Grinding Efficiency. Gordon T. Rideout. *Machinery,* v. 53, Jan. 1947, p. 158-164.

Grinding wheels made of a new fused aluminum abrasive, 32 Alundum, have been developed primarily for machining high-tensile steels, but are also effective on such materials as cast iron, high alloy steels, and some low-tensile metals.

20-49. Ingenious Mechanisms. *Machinery,* v. 53, Jan. 1947, p. 190-192.

Device for automatic shifting between two cam-operated packing mechanisms; mechanism for retarding an automatic feeding device.

20-50. Tool Engineering Ideas. *Machinery,* v. 53, Jan. 1947, p. 193-195.

Helical forming of strip stock without tearing the edge; device for indexing, locating, and feeding lock-washer blanks.

20-51. The Mechanism of Tool Vibration in the Cutting of Steel. R. N. Arnold. *Institution of Mechanical Engineers Journal,* Dec. 1946, p. 261-276; discussion, p. 276-284.

Fundamental investigations. Causes of the phenomenon and limitations of speed, tool frequency, and sharpness, outside of which vibration does not occur. Failure of carbide tools as a result of vibration is shown to occur in the form of a fatigue crack spreading inward parallel to the top face of the tool. Photographs and profile records of surfaces cut under various conditions; also a theoretical analysis. A few practical examples. 13 ref.

20-52. X-Ray Diffraction Analysis of Cold Work Produced by Face Milling. F. Zankl, A. G. Barkow, and A. O. Schmidt. *Iron Age,* v. 159, Jan. 23, 1947, p. 44-50.

Tests show that a negative rake produces more intense and deeper cold working, in addition to requiring more power.

For additional annotations indexed in other sections, see:

7-23; **12**-1-6-16; **14**-31; **23**-16-19; **24**-1-2-12-19-27; **26**-8; **27**-2-21.

21 LUBRICATION and Friction; Bearings

21-1. Treatments of Drawing Compounds. *Steel,* v. 119, Dec. 30, 1946, p. 96.

Additions of sulphur, antioxidants, polar compounds and inert organic materials impart specific qualities to drawing compounds.

21-2. Pointers on Pouring Babbitt Bearings. K. T. MacGill. *Western Metals,* v. 4, Dec. 1946, p. 22-23.

Cleaning, melting, and pouring of the bearings.

21-3. Rolling Bearing Technique. R. K. Allan. *Machinery (London),* v. 69, Dec. 12, 1946, p. 758-761.

The geometry of various possible roller bearing designs and contact areas calculated for different types. From this, the loads per unit area for a given total load are worked out. Amounts of radial and plastic deformation for different loads; load distribution within the bearing. (To be continued.)

21-4. Forming Lubricants. Gilbert C. Close. *Finish,* v. 4, Jan. 1947, p. 19-22, 60, 62.

Variables affecting choice of the proper lubricant; how proper lubricant is selected; importance of boundary lubrication. Ten desirable properties of a forming lubricant.

21-5. Kinetic Friction in or Near the Boundary Region. I. Apparatus and Experimental Methods. B. Chalmers, P. G. Forrester and E. F. Phelps. *Proceedings of the Royal Society,* v. 187, Dec. 13, 1946, p. 430-439.

When the lubricant between two surfaces is unable to carry the load, we have a mixture of boundary friction and fluid lubrication. Relative advantages of two methods for obtaining relatively pure boundary friction and a method in which conditions of load, speed, and contact area are controlled to give little opportunity for fluid film formation. One specimen is driven at a fixed velocity and the second is applied by a dead load. Reproducibility of determination is about 10%. 14 ref.

21-6. Kinetic Friction in or Near the Boundary Region. II. The Influence of Sliding Velocity and Other Variables on Kinetic Friction in or Near the Boundary Region. P. G. Forrester. *Proceedings of the Royal Society,* v. 187, Dec. 13, 1946, p. 439-463.

Friction of several different combinations of materials was measured under three different conditions: dry, with excess of various lubricants, and with thin films of various lubricants applied in two ways. Results show that changes in friction with velocity may be derived from at least three sources. Effects of surface finish and of continual sliding or "running-in".

21-7. Conditions Leading to Fatigue Failure in Sleeve Bearings. R. W. K. Honeycombe. *Symposium on the Failure of Metals by Fatigue, University of Melbourne Preprint* 21, Dec. 1946, 18 p.

Requirements of a good bearing alloy. Influence of load, speed, temperature and composition on the fatigue failure of bearings. Influence of stresses superimposed on the fatigue stresses. Such stresses arise from the differential thermal expansions of bearing alloy and backing and in the noncubic tin and cadmium-base bearing alloys, also from the anisotropy of thermal expansion. Changes which have been made in modern practice to eliminate fatigue as a cause of bearing failure.

21-8. How to Pour Babbitt Bearings. K. T. MacGill. *Iron Age,* v. 159, Jan. 9, 1947, p. 50-51.

Simple, but effective, procedures for pouring babbitt to produce sound, dependable bearings. Discussion is an outgrowth of a survey conducted by the babbitt and bearing division of Joseph T. Ryerson & Son, Inc.

21-9. Measurement of Lubricant Film Strength in the Region of Boundary Friction. Part II. Victor A. Ryan. *Lubrication Engineering,* v. 2, Dec. 1946, p. 166-168.

Illustrates manner in which 1-min. transition load and 3-min. transition pressure tests were used in solution of problem of securing or producing a lubricant for a newly invented machine designed for splash oiling. Parts to be lubricated comprised several heavy cam and roller closing mechanisms operating at extreme pressures, dies for stamping and drawing metal, and very thin slides for moving the drawn stock. Lubricant had to function as an extreme pressure lubricant to prevent seizure between cams and rollers, as a drawing oil to prevent scuffing on the drawn stock and the dies, and as a light viscosity lubricant to oil the thin slides.

21-10. Bibliography of Papers and Books on Lubrication and Related Subjects Published in Germany During the Period 1940 to 1944. H. Blok. *Lubrication Engineering,* v. 2, Dec. 1946, p. 169-171.

Continues bibliography started in September issue. Completes 1942, 1943 and part of 1944. 99 ref.

21-11. Oleophobic Monolayers. I. Films Adsorbed From Solution in Nonpolar Liquids. W. C. Bigelow, D. L. Pickett and W. A. Zisman. *Journal of Colloid Science,* v. 1, Dec. 1946, p. 513-538.

Certain types of polar organic molecules are adsorbed from solutions in nonpolar solvents to form well-oriented monolayers on polished solid surfaces. Such monolayers impart both hydrophobic and oleophobic properties to the polished surfaces of a variety of metallic and nonmetallic solids and can be formed from a large variety of solvents. These films and the information obtained in this study are thought to be applicable to research on oiliness, wear prevention, emulsification, detergency, wetting and the inhibition of rusting of steel with polar compounds. 23 ref.

21-12. Aluminum Alloy Bearings. H. Y. Hunsicker. *Machine Design,* v. 19, Jan. 1947, p. 121-127.

Properties, applications, and design data on some of the most promising alloys. (Abstract of a paper for American Society for Metals at Atlantic City Metal Congress.)

21-13. Rolling Bearing Technique. Part II. R. K. Allan. *Machinery (London),* v. 69, Dec. 9, 1946, p. 793-796.

Attention is directed to the question of rotational speed. (Abstract of the second part of paper for the Institution of Production Engineers, London.)

(Turn to page 40)

National Officers' Night at Dayton

Reported by William McCrabb
Dayton Rust-Proof Co.

Grouped before the Christmas tree at the December 18th meeting of the Dayton Chapter ⊕ are (left to right) J. D. Lovely, chapter treasurer; C. L. Gillum, secretary; A. L. Boegehold, national president; R. W. Edmonson, chapter chairman; R. P. Koehring, technical chairman; S. M. DePoy, vice-chairman; and W. H. Eisenman, national secretary. Mr. Eisenman gave a report on the progress of the society and an account of the National Metal Congress held in November.

Mr. Boegehold was introduced by Roland Koehring of Moraine Products Division, an old friend and colleague. Mr. Boegehold's address was on the subject of hardenability. Although this was the same topic he presented at the Tri-Chapter Meeting last year, his treatment was by no means a repetition, but included much new data on standardization of testing methods and comparisons with cooling rates and cooling times.

Pitt Has Christmas Party

Reported by Hans J. Heine
Metallurgist, Rockwell Mfg. Co.

Pittsburgh district's scientists are not superstitious, and the annual Christmas Party of the Chapter was held on Friday, Dec. 13, at Hotel Schenley. John F. Robb of Climax Molybdenum Co. was in charge of arrangements. There was entertainment galore, including "atomic" blondes in a floor show which raised temperatures to near the "upper critical". Fortunately there were beer and liquid prizes for "isothermal quenching", and stabilizing of the superheated molecules.

22 WELDING
Flame Cutting; Riveting

22-1. Repair Welding of Steel Castings. Orville T. Barnett. *Foundry*, v. 75, Jan. 1947, p. 74-76, 202-203, 206, 208, 210.
Removal of defects and preparation for welding; establishment of welding procedure; adoption of suitable electrode type.

22-2. Designing for Silver Brazing With Induction Heating. John B. Ross. *Iron Age*, v. 158, Dec. 26, 1946, p. 62-65.
In designing joints to be silver brazed, attention must be paid to the amount of clearance between the mating parts. Factors influencing this clearance, and the precautions to be observed in selecting coils to be used for induction heating of the brazing area.

22-3. Pressure Welding of Aluminum Alloys. H. Herrmann. *Machinery (London)*, v. 69, Nov. 28, 1945, p. 692-695.
Method of pressure welding that was developed at the Junkers-Flugzeugund Motorenwerken A.G. Mechanical application of hammer welding to production of cooler element.

22-4. Hints on Bronze Surfacing. *Linde Tips*, v. 26, Jan. 1947, p. 20-21.
Time-saving methods and finishing tools used in building up rings; shaping built-up gear teeth; rebuilding axles.

22-5. Add Another Blowpipe and Increase Profits. *Linde Tips*, v. 26, Jan. 1947, p. 22-23.
Production operations where two or more blowpipes are used to increase machine output.

22-6. Why Use E6012 Electrodes? Orville T. Barnett. *Steel*, v. 119, Dec. 30, 1946, p. 73, 106, 108.
Why this type is in greater demand today than other electrodes; ductility; X-ray soundness; penetration; freedom from undercut; faster welding of light sections with large diameter electrodes.

22-7. Welding Alloy Steel Piping. Eric R. Seabloom. *Heating, Piping & Air Conditioning*, v. 18, Dec. 1946, p. 79-83.
How to weld, braze, and solder chromium-nickel types of stainless steel.

22-8. Fixtures Make Welders Flexible. Part II. Ed Reilly. *American Machinist*, v. 91, Jan. 2, 1947, p. 74-75.
The range of work that can be readily assembled by standard welders is limited only by the designer of jigs and fixtures.

22-9. Fabricating Sheet Metal Parts of Jet Engines. Harold A. Knight. *Materials & Methods*, v. 24, Dec. 1946, p. 1461-1465.
Parts include combustion chambers, ducts and cones. Stainless steel, usually Type 347, was the preponderant material used for parts in the I-40 jet engine, which powered the famous Shooting Star jet plane. Inconel was used for liners in the combustion chambers and bronze wire screen and aluminum foil were used for insulation. Four types of welding used; gives welding details.

22-10. The Argon-Arc Process for Welding Magnesium and Aluminum Alloys and Stainless Steel. R. E. Dore. *Sheet Metal Industries*, v. 23, Dec. 1946, p. 2405-2415, 2420.
Equipment; setting up the equipment; welding with direct current; alternating current welding; comparison of a.c. and d.c. welding; welding technique for magnesium; welding of stainless steel; automatic argon-arc welding; results of welding tests on magnesium alloys; results obtained on other metals.

22-11. The Welding of Nonferrous Metals. Part VIII. (Continued.) E. G. West. *Sheet Metal Industries*, v. 23, Dec. 1946, p. 2416-2420.
Welding procedures; welding of tubes; finishing of copper welds; testing and inspecting copper welds. (To be concluded.)

22-12. Riveting Aluminum Ships. Harold J. Andrews. *Fasteners*, v. 3, no. 5, 1946, p. 4-5.
Ten-year test of experimental hull section in Chesapeake Bay salt water shows that cold driven 535 rivets are just as resistant to corrosion as those driven hot.

22-13. Shape-Cutting With a Portable Machine. *Linde Tips*, v. 26, Jan. 1947, p. 5-12.
Aids for cutting irregular shapes with the CM-16.

22-14. Weldability of Aluminum. G. G. Landis. *Light Metal Age*, v. 4, Dec. 1946, p. 8-13.
Some of the factors affecting efficiency in welding of pure aluminum and aluminum alloys. Mechanical properties of commercial weldable aluminum alloys and general procedures using a metallic arc. Manual welding of aluminum structures and typical applications of automatic carbon-arc welding.

22-15. Welding in Warship Research Work. *Welder*, v. 15, July-Sept. 1946, p. 49-50.
Outlines scope of research carried on at the Naval Construction Research Establishment at Rosyth, England.

22-16. Electric Arc Welding in H.M. Dockyards. *Welder*, v. 15, July-Sept. 1946, p. 51-55.
A crankshaft repair is described in detail. (To be continued.)

22-17. The Work of the Admiralty Ship Welding Committee. Amos L. Ayre and G. M. Boyd. *Welder*, v. 15, July-Sept. 1946, p. 56-61.
A few spectacular failures in welded ships, which led to the research work described, were characterized by the following main features: They consisted in sudden, extensive fractures accompanied by little or no deformation of the fractured edges; similar fractures had only very rarely occurred in riveted ships; fractures were seldom confined to the welds, but affected large areas of plating remote from welds; with few exceptions the fractures originated at some kind of notch effect, such as a square hatch corner, break of superstructure, or defective weld; there was a noticeable tendency for the fractures to occur in cold weather or in the refrigerated cargo spaces.

22-18. The All-Welded Tanker "Phoenix". William Arnold Stewart. *Welder*, v. 15, July-Sept. 1946, p. 62-68.
Development; characteristics; design; assemblies; welding; performance. Detailed drawings.

22-19. All-Welded Submarines Built at Chatham Dockyards. *Welder*, v. 15, July-Sept. 1946, p. 69-72, 74, 75.
History of the application and development of welding in submarine structure.

22-20. Molybdenum Steel Riveting. *Engineering*, v. 162, Dec. 13, 1946, p. 561.
Ingenious device used in the assembly of turbine blading which eliminates previous difficulties caused by short life of the tungsten-copper tips of the electrical riveting machines.

22-21. Taking Stock of Resistance Welding. Part I. John E. Ponkow. *Industry and Welding*, v. 19, Dec. 1946, p. 44-45, 78-80.
New techniques in the spot welding of aluminum and galvanized material.

22-22. Repair Maintenance in the Plant Weldery. *Industry and Welding*, v. 19, Dec. 1946, p. 48-49, 82, 86.
How oxy-acetylene and arc welding equipment help to keep things flowing continuously and efficiently at the Bernheim plant of Schenley Distillers Corp.

22-23. Resistance Welding Aids in the Production of Jet Engines. Frank G. Harkins. *Welding Journal*, v. 25, Dec. 1946, p. 1175-1178.
Setups used for welding of stainless elbow seams. Total fabrication time is 75 sec. as compared to 19.4 min. using atomic-hydrogen hand welding, and warpage rejections have been eliminated.

22-24. Welding and Other Fabrication Methods for Hastelloy Alloys. C. G. Chisholm. *Welding Journal*, v. 25, Dec. 1946, p. 1179-1183.
Recommended methods. Results of tensile tests at elevated temperatures tabulated and micrographs of broken test pieces shown.

22-25. Flame Cutting Operating Data. A. F. Chouinard. *Welding Journal*, v. 25, Dec. 1946, p. 1186-1188.
Charts presented which enable one to estimate oxygen consumption and cutting speeds for various thicknesses of steel plate. The construction of the charts is explained, and how to lay out the maximum number of disks on a given plate.

22-26. Projection Welding of Fasteners. Robert A. Reich. *Welding Journal*, v. 25, Dec. 1946, p. 1189-1192.
A method of resistance welding in which current flow and heating during the welding operation are localized at predetermined points. Methods and design considerations. Diagrams and pictures.

22-27. Efficiency of War-Born Operating Methods Is Inspiration for Today's Welding Production. A. F. Davis. *Welding Journal*, v. 25, Dec. 1946, p. 1193-1194.
How welded tank-tread units were fabricated by Cleveland Steel Erecting Co., Bedford, Ohio.

22-28. Expansion and Contraction. R. B. Aitchison. *Welding Journal*, v. 25, Dec. 1946, p. 1195-1202.
How the location and amount of expansion and contraction, buckling, warping, and other distortions which occur on heating a metal nonuniformly, as in welding, may be estimated. How this approximate information is applied to welding techniques.

22-29. Development of a Two-Row High-Strength Spot Welded Lap Joint in 24S-T Alclad Aluminum Alloy. L. M. Crawford and J. E. Pease. *Welding Journal*, v. 25, Dec. 1946, p. 1203-1210.
Development of above type of joint with over 50,000 psi. ultimate tensile strength, for each of several sheet thickness combinations in which all joints fractured by failure in the base metal along one row of welds.

22-30. Soft Soldering. Part II. *Metal Industry*, v. 69, Dec. 20, 1946, p. 508.
Investigation into the problems of solderability.

22-31. Arc Welding and Cutting Under Water. (Continued.) L. Mills. *Transactions of the Institute of Welding*, v. 9, Oct. 1946, p. 156-158, 167.
Results of tests made on three single V-butt welds produced under water. Tensile, bend and hardness tests were carried out on each weld. The bend test results were obtained by using apparatus as specified by the Admiralty, and the specimen bent with the wide face of the weld in tension. General principles of the equipment in oxy-hydrogen and oxy-carbon arc processes; choice of hydrogen as a preheating fuel; gas pressures; execution of an underwater cut.

22-32. Control of Distortion in Welded Ship Structures. George Johnson. *Transactions of the Institute of Welding*, v. 9, Oct. 1946, p. 159-167.
Factors influencing residual stress, and notes on stress relief, distortion in butt and fillet welds, minimum welding, welded shaft brackets and stern-posts, buckling, dimensional accuracy, and welding sequence.

22-33. Welding Fixtures for Mass Production. A. E. Rylander. *Tool Engineer*, v. 17, Jan. 1947, p. 32-41.
Simple fixtures and straightline flow

(Turn to page 42)

Complex Nature of Cast Iron Emphasized; Inoculants, Flakes and Fluidity Covered

Reported by Donald J. Henry
General Motors Research Laboratories

Detroit chapter members were treated to a comprehensive survey of the field of cast iron metallurgy on Nov. 11, when James T. MacKenzie, chief metallurgist of the American Cast Iron Pipe Co., spoke on "Metallurgical Aspects of Cast Iron".

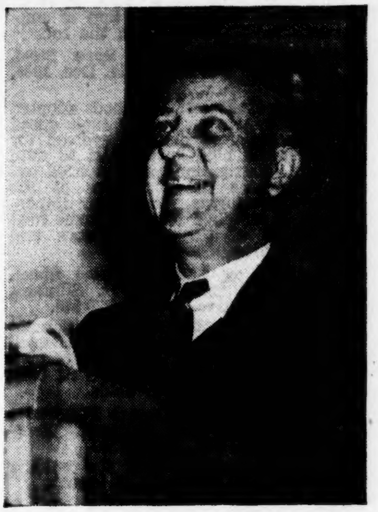
Dr. MacKenzie highlighted his talk with some observations made during his recent trip to Germany under the auspices of the Foreign Economic Administration. Three points he brought out were that the Germans did almost no research and development work in the field of cast iron metallurgy under the Nazis, that centrifugal casting practice in Germany followed British and American practice, and that good metallurgical coke was available throughout the war.

The complex nature of cast iron was emphasized in a series of slides showing how Brinell hardness, ultimate tensile strength, and Charpy impact strength vary with composition changes. This included a discussion of the effects of sulphur and phosphorus, of trace amounts of bismuth, tin, antimony, or lead, and also of late silicon additions and ladle inoculation.

Pointing out that there are two types of inoculants, graphitizing and stabilizing (of which the former is the more frequently used), Dr. MacKenzie discussed the two-fold function of graphitizing inoculants as being (*a*) to prevent the formation of massive cementite and (*b*) to modify the structure attained on freezing so that no eutectic (type D) graphite forms. Stabilizing inoculants inhibit graphite formation and regulate the depth of chill.

That individual graphite flakes and groups of flakes in gray iron are whorl-shaped was shown by photographs of three-dimensional models which were developed by applying a metallographic technique that involved photographing the same area of the specimen after polishing away successive layers of metal. This agrees with Boyles' theory that graphite flakes in hypo-eutectic irons form around the primary austenite grains.

Taking up the casting characteristics of iron, he discussed fluidity and the volume changes which occur during freezing and cooling. The foundryman controls fluidity by adjusting the carbon equivalent, a quantity derived by the formula (% C) + 0.3(% Si) + 0.3 (% P). This formula takes into account the fact that eutectic composition varies principally with carbon and silicon content, which is extremely important since fluidity increases up to the eutectic, then decreases due to kish formation. Cast iron expands during freezing as the result of graphite formation, and while this may favor more accurate reproduction of mold contours, it also introduces a serious problem where different section sizes occur in the same casting. The coincident volume changes in different sections can oppose each other, since thin, light sections freeze first and expand while the heavy sections are still liquid. When the heavy sections solidify their expansion is opposed by the tendency for the thin sections to contract.



Dr. MacKenzie at the Rostrum

Dr. MacKenzie's address was followed by a most interesting discussion period during which a number of cast iron problems confronting local metallurgists were emphasized.

Extruded Metals Merged

Merger of Extruded Metals, Inc., Belding, Mich., with the Detroit Gasket & Manufacturing Co., Detroit, was recently announced by Lloyd H. Diehl, president. John L. Barrett, former president of Extruded Metals, Inc., is now director and vice-president of the Detroit Gasket & Manufacturing Co. in charge of Extruded Metals Division. Russell A. Blanchard remains manager of the Belding plant. The Extruded Metals Division will continue to serve the automotive, refrigeration, building, cabinet, transportation and industrial industries with extrusions, and in addition supply products fabricated from extrusions.

Names Phila. Representative

The American Agile Corp. of Cleveland announces the appointment of the Monroe Sales Corp. of Philadelphia as exclusive sales representatives for the territory of Eastern Pennsylvania, Southern New Jersey, Maryland and Delaware. The seven field engineers of the Monroe organization will cover this territory with a complete line of Agile welding electrodes and parts.

Stress Effects Demonstrated

Reported by John R. Dobie
Heat Treat Foreman
American Steel & Wire Co.

"Residual Stresses—Their Good and Bad Effects" was the subject of the Dec. 11 meeting of Worcester Chapter at Hotel Sheraton, ably covered by John T. Norton, professor of physical metallurgy at Massachusetts Institute of Technology.

Professor Norton explained briefly the use of X-ray methods for measuring residual stresses, and accompanied his talk with slides and blackboard illustrations. He also had on display numerous items that had cracked as a result of stress and strain, and after explaining the cause of these failures, the parts were passed around.

Lloyd G. Field, vice-chairman of the chapter, presided, and Leo P. Tarasov was technical chairman for the evening.

Extrusion, Rolling And Drawing Practices Explained

Reported by Richard Paul Seelig
American Electro Metal Corp.

The first lecture in an educational series considering various methods of fabrication of metals, presented before the New York Chapter during the fall, covered extrusion, rolling and drawing, and was given by E. V. Crane, vice-president in charge of mechanical engineering, Sam Tour and Co., Inc.

Both hot and cold rolling operations were included, as well as certain borderline cases where no special heating operation is used but where the residual heat in the metal and the heat created by the deformation are sufficient to maintain the stock within its recrystallization range. An interesting example of modern rolling technique is the rolling of aluminum alloy sheet which is coated on both sides with a thin layer of pure aluminum.

Mr. Crane reported that in Germany, during the recent war, flasks for torpedoes were produced by drawing on huge presses. In creating cup-shaped articles by extrusion, elongations of as much as 1300% are utilized.

In cold drawing operations on presses the importance of controlling blank-holding pressures was emphasized by means of numerous slides. The maximum reduction in the first draw usually should not exceed 38 to 45%.

An interesting discussion covered the theory of workhardening and what was described by Mr. Crane as the "crystoplastic" range. Density of the material is greater in the annealed state than as cold worked. The theory, based on the development of slip planes in tension and compression, serves to explain the difference between pure metals and alloys in their reaction to cold working.

of materials result in ease of operation and a very high production potential. Station sequence and flow charts of various operations.

22-34. Pressure Welding Stainless Steel Rings. Charles J. Burch, Arnold L. Rustay, Alan Crowell, and Stephen M. Jablonski. *Steel,* v. 120, Jan. 13, 1947, p. 88-90, 92, 94-95. Also *Steel Processing,* v. 32, Dec. 1946, p. 782-787, 802-804, 812.

Progress report on the application of pressure welding to the production of stainless steel rings ranging in sizes up to 20 in. in diameter with cross sections from 1.5 to 4.5 sq.in. Close control of surface preparation, end pressure, and rate of heating are essential.

22-35. Decoding the Code Requirements for Welded Branches of Pressure Piping. A. B. Donkersley. *Power,* v. 91, Jan. 1947, p. 84-85.

Simple, dependable explanation.

22-36. How to Select Wear Resisting Alloys for Welding. Joseph A. Cunningham. *Machine Design,* v. 19, Jan. 1947, p. 139-142.

Ten factors to be considered when choosing hard surfacing electrodes or rods. Table presents basic information concerning a variety of hard facing alloys. How to minimize spalling.

22-37. 1 Braze + 120 Parts→1 Cylinder Block. John H. Giroux. *Welding Engineer,* v. 32, Jan. 1947, p. 40-42.

Design features of the engine for Crosley cars, plus operations and equipment involved in brazing the cylinder blocks.

22-38. Welding in Railroad Maintenance. Arthur Havens. *Welding Engineer,* v. 32, Jan. 1947, p. 43-46.

Engine trucks of faulty design successfully altered in a small locomotive repair shop. Problems of broken driving boxes solved by arc and gas welding.

22-39. Welded Gears Replace Castings. J H. Crumley. *Welding Engineer,* v. 32, Jan. 1947, p. 47.

Welding procedure; how distortion is eliminated.

22-40. Chrysler's Cycleweld Process. Stanley H. Brams. *Welding Engineer,* v. 32, Jan. 1947, p. 48-50.

How it differs from welding and forms a strong cemented bond. Some possible applications and design opportunities.

22-41. A Loom for Metal Fabric. *Welding Engineer,* v. 32, Jan. 1947, p. 53.

A 25-electrode multiple spot welder weaves wire mesh at production speeds.

22-42. Automatic Heaters Welded Automatically. M. G. Hawkins. *Welding Engineer,* v. 32, Jan. 1947, p. 58-60.

Various steps in manufacture of 40-gal. steel tank and its jacket.

22-43. Resistance Spot Welding Speeds Aircraft Fabrication. Part I. Frederick S. Dever. *Production Engineering & Management,* v. 19, Jan. 1947, p. 60-64.

Importance of design; spot groupings; material composition; facts for designer; replacing rivets; no sandblasting; assembly work.

22-44. Weld Done. *Industry and Welding,* v. 19, Jan. 1947, p. 30-33.

Story, in pictures, of welding operations at Ford Motor Co.

22-45. Production Welding the Postwar Washer. Fred Gandert. *Industry and Welding,* v. 19, Jan. 1947, p. 40-42.

Arc and resistance welding employed in construction of the Laundromat.

22-46. Flame Cutting Stainless Steel. *Industry and Welding,* v. 19, Jan. 1947, p. 54, 56.

Special fluxing process and a method of applying the flux in stainless steel cutting.

22-47. Electric-Arc-Oxygen Process Speeds Cutting of Alloy Steels. Vallory H. Laughner. *Machinery,* v. 53, Jan. 1947, p. 174-177.

A hollow electric rod and a stream of oxygen are combined in the "Oxyarc" cutting process to create temperatures that cut through alloy steels and nonferrous metals in but a fraction of the time formerly required. Thin sheet or plate up to 3 in. thick can be cut without distortion or contamination in one pass of the rod.

22-48. Arc Welding of High Speed Steel. D. D. Howat. *Welding,* v. 14, Dec. 1946, p. 544-556.

Report of successful methods adopted for the repair of broken high speed cutting tools. Technique evolved for welding the high speed steel to mild steel. Investigations were carried out to determine the properties of the welded specimens. Particular importance is attached to the correct heat treatment of the parts before and after welding.

22-49. Welding Stainless Steel Sheet. W. A. Woollcott and R. R. Sillifant. *Welding,* v. 14, Dec. 1946, p. 557-565.

Principles of the process, equipment required and its application to work on stainless steel sheet. Results of a metallurgical investigation of both manual and automatic welds.

22-50. Weed Cutting Launch Fabricated by Arc Welding. G. F. Fairman. *Welding,* v. 14, Dec. 1946, p. 567-569.

General description of the welding operations on this type of launch.

22-51. Oxygen Cutting. Part VI. E. Seymour Semper. *Welding,* v. 14, Dec. 1946, p. 570-574.

Latest type of equipment and technique with appropriate operating data. This section particularly deals with economic aspects.

22-52. Deep Fillet Gas Welding. *Iron Age,* v. 159, Jan. 23, 1947, p. 60-62.

Description of cost-saving process. (Translated from a discussion in *Autogene Metallbearbeitung.*)

22-53. A Few Observations on Solid Phase Bonding. George Durst. *Metal Progress,* v. 51, Jan. 1947, p. 97-101.

A general discussion of the theory of the joining of metals (similar and dissimilar) without use of welding, soldering, or brazing techniques. Brief references made to the literature and results of a few experiments included.

22-54. Heavy Cutting Applications in Foundry and Steel Mill. R. S. Babcock. *Welding Journal,* v. 26, Jan. 1947, p. 5-11.

Apparatus and techniques used for oxygen cutting of steel up to 66 in. thickness.

22-55. A New Stick Feeder Welding Apparatus. Joseph M. Tyrner. *Welding Journal,* v. 26, Jan. 1947, p. 13-16.

Tool consists of an inclined tube along which a carriage is propelled by a motor. The electrode is fastened to the carriage by means of an electrode holder. As the electrode burns down, the carriage moves along the tube with the proper speed to hold the desired arc length. Device is self-contained, portable, and easy to set up.

22-56. Resistance Welding of Spring Steel to Low-Carbon Steel. Arthur Willink. *Welding Journal,* v. 26, Jan. 1947, p. 30-31.

Technique was devised for production of snaps such as those used on harnesses. Explains how to prevent the quenching action of water-cooled electrodes in tight contact with the work due to pressure.

For additional annotations indexed in other sections, see:
3-22-23; **7**-39; **19**-34; **23**-2-20-22; **24**-16-17-23-30-31; **26**-10; **27**-5-27.

23 INDUSTRIAL USES and Applications

23-1. Magnesium in Electrical Batteries. Harold A. Knight. *Materials & Methods,* v. 24, Dec. 1946, p. 1469-1472.

Development work; comparison of magnesium batteries with conventional cells.

23-2. Welded Wrought Iron "Channels". *Steel,* v. 119, Dec. 30, 1946, p. 84.

Protective covers, fabricated of wrought iron plate, cover spalled concrete spandrels of an eight-story building in Chicago. Fabrication problem.

23-3. What's the Matter With Cast Iron? A. A. Weidman. *Society of Automotive Engineers Preprint,* 1946, 22 p.

Problems involved in the actual design in making castings, machining them, and the uses to which castings best can be put.

23-4. Aluminum for Water Works Structures. John M. Perryman. *Journal of the American Water Works Association,* v. 38, Dec. 1946, p. 1327-1329.

Use of aluminum for a 500,000-gal. water tank and auxiliary structures at Macon, Ga. Also recommends use of aluminum alloys for filter gallery piping. Corrosion resistance is said to make this metal most economical in the long run.

23-5. A Modern Electric Boiler Installation at Arvida. F. L. Lawton and M. G. Saunders. *Light Metals Review,* v. 6, Dec. 6, 1946, p. 27-28.

Boilers are insulated with aluminum foil, air cell insulation covered with an outside casing of aluminum sheet. Also, the main steam header, steam piping and connections to the main steam distribution line are insulated in a similar manner. Aluminum foil is fireproof, does not absorb moisture with consequent loss of heat insulating properties, and is permanent. Details of application of this insulation. (Abstracted from *Engineering Journal,* v. 29, May 1946, p. 290-298.

23-6. Cleveland Commentary: Aluminum Prospects and Problems. L. Pomeroy. *Light Metals Review,* v. 6, Dec. 1946, p. 41-42.

Aluminum in automotive use. (Abstracted from *Motor,* v. 40, Nov. 9, 1946, p. 119-122.)

23-7. Corrosion Resistant Processing Equipment of Clad Steels for Chemical and Allied Industries. Everett C. Gosnell. *Corrosion,* v. 2, Dec. 1946, p. 287-306.

Fabricating techniques for clad steel plate, and techniques for selection of material. Design and fabrication of equipment from clad steel. Various industrial applications.

23-8. Aluminum Die-Cast Engines. G. C. Robechaud. *Modern Metals,* v. 2, Dec. 1946, p. 15.

New line of light weight industrial engines utilizes high-pressure aluminum die castings throughout.

23-9. Fundamental Considerations in the Developing Magnesium Industry. J. D. Hanawalt. *Modern Metals,* v. 2, Dec. 1946, p. 16-23.

Problem of achieving wider acceptance of magnesium. Some of the advantages of magnesium's unique property combinations and obvious fields for application development.

23-10. Looking Forward to Future Automobile Engines. Part IV. Alex Taub. *Automotive and Aviation Industries,* v. 95, Dec. 15, 1946, p. 40-42, 58, 60.

Improvements in pistons, rings, valves.

23-11. The Chemical News Parade. Bosch Process. *Chemical and Engineering News,* v. 24, Dec. 25, 1946, p. 3356-3357.

German process in which a very thin coating of zinc applied in vapor form directly on the paper dielectric

(Turn to page 44)

Precision Casting Discussed As Method of Metal Fabrication

Reported by Richard Paul Seelig
American Electro Metal Corp.

Two lectures presented during December as part of the educational series of the New York Chapter covered the subject of "Lost Replica Casting". The entire series of lectures covered various aspects of the fabrication of metals. The first of these two lectures was presented by Paul Butler of the J. R. Wood Products Corp., on the materials and methods used. The second covered design considerations and was given by W. J. Matthes of the same company.

Mr. Butler gave a clear description of the process, starting with the metal mold, through the wax pattern stage, assembly of the patterns into "trees", making of the investment mold, and finally pouring of the hot metal. The word "investment" was defined as a mold without parting line.

Three variables must be taken into account when planning dimensional control: (*a*) solidification shrinkage of the wax pattern; (*b*) shrinkage of the molten metal; and (*c*) expansion and contraction of the investment material. The accuracy of the wax pattern depends not only upon the wax itself, but also on the temperature, time, and pressure used in injecting it into the metal mold.

For low melting metals such as magnesium, aluminum, brasses and bronzes, combinations of plaster of paris and silica are used as investment materials. For higher melting alloys the investment consists of 95% silica with a special binder such as ethyl silicate, alcohol and water, but many others, some of them secret, are also employed.

In answer to a frequently raised question concerning materials that can be precision cast, Mr. Butler pointed out that there is no actual limitation. The only thing that cannot be done by this process is to produce a structure similar to that of worked metal. However, through changes in composition or treatment, equivalent properties can almost invariably be produced.

In the second lecture on "Design Considerations", Mr. Matthes pointed out the need for cooperation between producer and consumer. There is no such thing as a typical lost wax casting, but there are many suitable castings in typical applications.

Sizes ranging from 1/10 in. to 4 in., and even up to 7 in., can readily be handled. Tolerances are usually quoted as ±0.002 in. per in. for nonferrous materials and ±0.003 in. per in. for steels and similar materials. Closer tolerances can be held, if necessary, at greater cost, by means of reworking the molds and additional control over each step in the manufacture. Factors that determine the accuracy to which the casting can be made are lubrication of the mold, uniformity of the investment, temperature of the flask, and temperature of the metal cast. In addition, the condition of the wax should be borne in mind.

Threads can be cast, but it is usually more economical to machine them. Holes as small as 0.020 in. diameter, and ⅜ in. deep have been cast on thousands of production pieces. Blind-end holes should be avoided.

Metals Review Staff Changes

Several changes have been made in Metals Review *personnel starting in January 1947. Ray T. Bayless, editor since the paper was established in 1930, has been made publishing director, and Marjorie R. Hyslop, managing editor since 1934, is now editor. George H. Loughner, who has been in the advertising production department of* Metal Progress *since 1944, has been added to the staff as production manager.*

Aluminum Bronze Used For Nongalling Draw Dies

Reported by R. C. Hendrickson
Metallurgist
Bausch and Lomb Optical Co.

To an audience of metallurgists and foundrymen from the Rochester area, Walter W. Edens, superintendent of foundries, Ampco Metal Co., described the properties and applications of high-strength bronzes. Beginning with a brief story of the romance of copper, Mr. Edens went on to show the effect of alloying elements on physical properties of cast and wrought copper-base materials.

Highlighting Mr. Edens's address was his presentation of the metallurgical aspects of the aluminum bronze alloys. Photomicrographs and equilibrium diagrams clearly illustrated the structures of these high-strength bronzes.

Among the industrial uses of this alloy are draw dies for aluminum and stainless steel. The 14% aluminum, 4.5% iron alloy having a Brinell hardness of about 340 is used in this application. Its nongalling properties have been found ideal for smooth draw work.

is substituted for the metal foil used in conventional fixed paper condensers. The machinery for the manufacture of the paper has been brought to this country where details are being worked out.

23-12. The Aluminum Automobile. W. D. Kendall. *Aluminum and Magnesium,* v. 3, Dec. 1946, p. 20-21, 25.

Main frame of the Kendall is constructed of six aluminum cast members bolted together, with tubular steel transverse bracing members. Unique features of this form of construction. Other design innovations.

23-13. Gramophone Needle Manufacture. *Machinery (London),* v. 69, Dec. 12, 1946, p. 756-757.

Describes methods employed at Needle Industries, Ltd., Studley. Pointing, shearing, scouring, glazing and packing.

23-14. Use of Recently Developed Building Materials in Railway Buildings. Report on Assignment 6 by A.R.E.A. Committee 6—Buildings. *American Railway Engineering Association Bulletin,* v. 48, no. 463, Dec. 1946, p. 300-318.

Materials include, among others, enameled steel tile and structural aluminum.

23-15. A Plumbing Goods Plant. *Western Metals,* v. 4, Dec. 1946, p. 24-27.

Pictures show production processes involved in making faucets from brass stampings and precision-machined brass fittings which are subassembled and permanently silver-brazed. Parts are then sanded, buffed, polished and given an exceptionally heavy chromium plating. Final inspection includes rigid testing for leaks. Product is jewelry-polished to a high finish, packaged and shipped immediately.

23-16. The Development of Light Constructions. All-Steel Lathes. W. Mobius. *Engineers' Digest (American Edition),* v. 3, Dec. 1946, p. 603-606.

Two experimental lathes, one having "cell construction" and the other "tube construction". Cost and weight comparisons, and results of workshop tests and static and dynamic examinations. Latter shows superiority of tubular construction. Development of welded all-steel lathes believed practicable. (Condensed from *VDI-Zeitschrift,* v. 88, May 27, 1944, p. 277-286.)

23-17. Selecting Steels for Casting Dies. Herbert Chase. *Steel,* v. 120, Jan. 13, 1947, p. 98, 100, 109.

In spite of wide differences of opinion on specifications for die steels, many different compositions and heat treatments yield satisfactory results.

23-18. Insulated Cables and Wire in Aluminum. *Light Metals,* v. 9, Dec. 1946, p. 648-684.

Practical aspects of the replacement of copper by aluminum; the problem of joining.

23-19. Report on Bristol Type 167. *Aircraft Production,* v. 8, Dec. 1946, p. 561-569.

Description of manufacturing processes continues with an account of the machining and forming of the extruded stringers and a review of the main fuselage assembly.

23-20. Alloy Steels for Welded Locomotive Boilers. H. L. Miller. *Railway Mechanical Engineer,* v. 121, Jan. 1947, p. 6-8, 15.

Materials suitable for welded boilers, the welding procedures which should be used, and the possible advantages of stronger materials.

23-21. Briggs Manufacturing Company Achieving High Volume Production With New Porcelain Enameling Facilities. *Better Enameling,* v. 18, Jan. 1947, p. 11-14.

An account of production of steel plumbing fixtures.

23-22. Welded Construction Provides Economical and Rigid Shop Structure. A. F. Davis. *Welding Journal,* v. 26, Jan. 1947, p. 18.

A prefabricated shop building of standard universal design sold by the Butler Manufacturing Co., Kansas City, Mo.

For additional annotations indexed in other sections, see: **3**-1-2-7; **5**-3-4-5; **7**-4; **8**-3; **14**-22-28; **19**-19-24-25; **20**-23-25-26-29-46; **22**-9-27-37-38-41-42-45; **24**-7-13-15-18; **25**-9; **27**-13-17-18.

24 DESIGN

24-1. An Analysis of Involute Sliding. Ben Bloomfield. *American Machinist,* v. 91, Jan. 2, 1947, p. 96-97.

Mathematical analysis of the sliding which takes place between the teeth of involute gears shows that involute contact near the base circle causes excessive wear which may result in scuffing or pitting. Higher active pressure angles and the use of enlarged and reduced combinations, or long and short addenda, tend to reduce the amount of involute sliding.

24-2. Method of Checking Compound Angles. James Ahearn. *Machinery (London),* v. 69, Nov. 28, 1946, p. 688-691.

Method of checking compound angles has the advantage of not requiring any master blocks or parts. Single setup will serve to cover any combination of component angles, each of which may range from 0 to 90°.

24-3. Alclad. W. Thompson. *Metal Industry,* v. 69, Dec. 6, 1946, p. 465-466.

Investigation of some stress-strain characteristics shows that after tests had been carried out on Alclad to specifications D.T.D. 390, 546 and 610, in both the as-received and heat treated conditions, a distinct change was found in the straightline portion of the stress-strain diagrams.

24-4. General Stress-Strain Laws of Elasticity and Plasticity. A. Gleyzal. *Journal of Applied Mechanics,* v. 13, Dec. 1946, p. A261-A264.

Stress-strain laws discussed apply to problems where the material is elastic in some regions and plastic in others, for example, in a plastic-torsion problem or in a plastic-bending problem. These laws have experimental verification for metals in cases where strains are small and stresses and strains are either monotonically increasing or monotonically decreasing at any one point.

24-5. Notes on Stresses in Helical Springs. *Mainspring,* v. 11, Dec. 1946, 4 p.

Methods for evaluating the various stresses set up in helical springs during manufacture and operation; significance of these stresses in terms of fatigue life or excessive set.

24-6. Residual Stresses in Aluminum Alloys. R. M. Brick. *Aluminum and Magnesium,* v. 3, Dec. 1946, p. 8-11, 26-27.

Significance of terms; possible effects of residual stresses; measurement of stress intensity by mechanical methods, such as boring, cutting, slitting; typical data on quenched aluminum alloy cylinders; use of wire strain gage and strain rosettes for determining both the direction and intensity of principal stresses; X-ray analyses of machining and other stresses in aluminum alloy shapes; thermal origin of stress and control methods; stresses originating in mechanical deformation processes; stress-relief annealing. (To be concluded.)

24-7. Some Advantages and Assets of Magnesium. R. J. Cross. *Aluminum and Magnesium,* v. 3, Dec. 1946, p. 17-19, 33.

Comparative load-strain curves obtained from tensile test pieces of different materials which show that the specific ultimate strength of even low strength weldable magnesium-manganese alloy closely approaches that of commonly used high-strength aluminums. Use of magnesium for aircraft fuel tanks and their fabrication by welding is stressed. Beer crate is the typical civilian use.

24-8. Designing of "Trouble-Free" Dies. Part LXIV. C. W. Hinman. *Modern Industrial Press,* v. 8, Dec. 1946, p. 18.

Shaving portions of fiber blanks for squaring.

24-9. Predicting Bolt Tension. G. A. Maney. *Fasteners,* v. 3, no. 5, 1946, p. 16-18.

Investigation was undertaken to find out how accurately tensions could be estimated from a measurement of the torque applied in tightening the nut. Preliminary results on low-carbon steel, rolled-thread, stress-relieved bolts indicate that a fair approximation of applied load may be obtained in this way.

24-10. Diamond Hardmetal Drill Bits. H. N. Tegkayev. *Industrial Diamond Review,* v. 6, Dec. 1946, p. 377.

New design of drill bit for exploratory and production work in mining. (Abstracted from *Gornii Journal,* March 1946, p. 25-56.)

24-11. Design of Exhaust Systems. Part XXIX. F. H. Stebbins. *Sheet Metal Worker,* v. 37, Dec. 1946, p. 48-50, 56.

Elimination of gold, silver and platinum dust by proper type of exhaust system.

24-12. Flexible Couplings. *Western Machinery and Steel World,* v. 37, Dec. 1946, p. 112-114.

Design details of three main types: large link and pin type coupling; the intermediate type, which consists of two flanges pinned together through a leather disk; and the smallest type, which is essentially a leather bushing within one of two pinned flanges.

24-13. Development of Jacketed-Type Steel Drier Rolls. William H. Funk. *Steel Processing,* v. 32, Dec. 1946, p. 775-779, 791.

Use of welded steel single-shell drier roll, installed as a replacement in a bank of cast iron drier rolls in which there had been a failure, provoked considerable thought and discussion because of the increased operating efficiency and longer bearing life, through improved journal design, which resulted. Advantages have continued over the more than 12 years of nearly continuous service rendered by the drier roll which is operating in a mill making paper board. Various design problems.

24-14. Designing, Drafting and Using Press Tools. C. W. Hinman. *Steel Processing,* v. 32, Dec. 1946, p. 788-791.

Problem concerns forming a steel tube and joining its ends. Nomenclature of the die parts shown in drawing. Operation of the die.

24-15. Current Automotive Bumper Designs Introduce New Production Problems. *Steel Processing,* v. 32, Dec. 1946, p. 792-794.

Brief history of development of bumpers. Materials, design, and production problems of bumpers for automobiles, trucks and buses.

24-16. Structural Investigation in Still Water of the Welded Tanker "Neverita". F. B. Bull. *Welding Journal,* v. 25, Dec. 1946, p. 809s-843s.

Some of the instruments and methods developed in British work. Fac-

(Turn to page 46)

Precision Casting Process Outlined And Illustrated

Reported by William McCrabb
Dayton Rust Proof Co.

A display of precision cast parts augmented by a unique projection method for illustrating various points added to the interest of an excellent lecture on precision casting presented before the Dayton Chapter ⊕ by Robert M. Kerr, Jr., of Kerr Mfg. Co., Detroit.

Briefly, the process consists of making a model replica of the piece to be produced, embedding it in some refractory or investment material, burning out the model, leaving a cavity into which is cast the metal for the finished part. The model is made of either wax or plastic. Mr. Kerr prefers wax because it is easier to handle and sometimes may be partially reclaimed while plastic may not. The model is made by casing the wax or plastic into molds made of rubber or soft metal such as Cerro-Bend. When greater mold life and accuracy are important, steel is used for the mold.

Once the model is obtained it must then be invested into a suitable material. Plaster of paris binders with quartz and cristobalite refractories are used for casting the low-temperature metals. Silica refractories, usually with silicate binders, are used in casting steels. There are several ways of investing: (*a*) pour around model; (*b*) vibrate and pack; (*c*) dip coat before investing. Mr. Kerr prefers to mix the materials for investment with a slow-moving bread mixer using a 29.5 vacuum to eliminate bubbles of gas.

After the investment sets it is slowly fired to remove the model of wax or plastic. This is done in an oxidizing atmosphere to insure complete combustion of the model material; the latter should have extremely low ash content.

The mold is ready for casting the metal after further firing to a temperature of 1500° F. Careful gating and spruing is necessary to control shrinkage and to keep the metal flowing into bulky portions of the casting. The sprues are usually short and thick.

If sufficient centrifugal speed is maintained strength of the cast is equivalent to that of cold rolled metal. Ultimate properties of the metal are affected by cooling rates, melting conditions, and heat treatment; these characteristics determine the competitive situation with regard to forgings, die castings, and machined parts. Precision castings are expensive singly but cost goes down with increase in quantity. This method of casting is especially applicable where the product can be cast as one piece, compared to a number of parts made on screw machines or by other methods which must be united into a single assembly.

Cooper Demonstrates Resistance Welds

J. H. Cooper of Taylor-Winfield Corp. Shows a Sample of Spot Welding to a Group of Technical Assistants From the Caterpillar Tractor Co. Metallurgical Laboratory Before the Peoria Chapter Meeting

New Spot Welding Techniques Shown

Reported by A. G. Phillips
Caterpillar Tractor Co.

Some of the new, unusual, and little publicized resistance welding techniques that came out of the war were described at a joint meeting of the Peoria Chapter ⊕, and the Peoria Chapter of the American Welding Society on Nov. 11. Speaker was J. H. Cooper, chief sales engineer for the Taylor-Winfield Corp., Warren, Ohio.

Mr. Cooper said that materials like spring steel and armor plate have been spot welded so that a nonbrittle structure of tempered martensite is obtained in the weld. This is done by using a double current impulse. The first impulse welds the material but the rapid quench provided by the cold surrounding metal produces a hard, martensitic structure. Without removing the electrode pressure, a second impulse is given which tempers and softens this brittle structure. This method of welding was used in the manufacture of armored half-tracs during the war.

Few companies were spot welding magnesium or aluminum alloys before the war, for welding of these metals was handicapped by high power requirements. During the war a method for storing electrical energy was developed. Energy can be released when needed to make a spot weld and power demands are greatly reduced when storing the energy. Spot welding of aluminum was used in aircraft assemblies during the war and resulted in increased ease of assembly and decreased air resistance in flight as compared with riveting.

Mr. Cooper concluded his talk with a series of slides and a short movie.

NATIONAL MEETINGS *for March*

Mar. 2-5—American Society of Mechanical Engineers. Spring Meeting, Mayo Hotel, Tulsa, Okla. (Ernest Hartford, Executive Assistant Secretary, A.S.M.E., 29 West 39th St., New York 18, N. Y.)

Mar. 17-22—American Institute of Mining and Metallurgical Engineers. 75th Anniversary Celebration and World Conference on Mineral Resources, Waldorf-Astoria Hotel, New York. (E. O. Kirkendall, A.I.M.E., 29 West 39th St., New York 18, N. Y.)

Mar. 17-19—American Gas Association. A.G.A. Sales Conference on Industrial and Commercial Gas, Copley Plaza Hotel, Boston. (Karl Emmerling, Industrial and Commercial Gas Section, A.G.A., 420 Lexington Ave., New York 17, N. Y.)

Mar. 17-19—American Society of Lubrication Engineers. Annual Meeting, Pittsburgh.

Mar. 19-22—American Society of Tool Engineers. Annual Convention, Rice Hotel, Houston, Texas. (Harry E. Conrad, Executive Secretary, A.S.T.E., 1666 Penobscot Bldg., Detroit 26, Mich.)

Mar. 22-27—Fifth Western Metal Congress and Exposition, Civic Auditoriums, Oakland, Calif. (W. H. Eisenman, Secretary, American Society for Metals, 7301 Euclid Ave., Cleveland 3, Ohio.)

Mar. 31—Apr. 2—Midwest Power Conference, Palmer House, Chicago. (Stanton E. Winston, Director of the Conference, Illinois Institute of Technology, 41-43 West 33rd St., Chicago 16, Ill.)

tors influencing their design. Methods of using the instruments and their principles of operation are described. Details of the tests and their results. Tables, charts, and diagrams.

24-17. Variation of Longitudinal Residual Strain Through the Thickness of a 1-In. Unionmelt Weld. J. L. Meriam, Finn Jonassen and E. Paul DeGarmo. *Welding Journal,* v. 25, Dec. 1946, p. 844s-847s.

A series of tests was conducted in order to better interpret the residual weld stresses as measured with surface gages in terms of the strain condition in the interior of the weld. Experimental procedures and results are shown by charts and diagrams.

24-18. The Prospects of the Steam Cycle in the Central Power Station. (Continued.) G. H. Martin. *Engineers' Digest,* v. 3, Dec. 1946, p. 597-598.

Problems of construction, including performance of various metals and alloys for stressed high-temperature service; design of feed systems. (Condensed from Advance Copy, Institution of Mechanical Engineers, Sept. 1946, 8 p.)

24-19. Drilling and Boring Tools. *Tool Engineer,* v. 17, Jan. 1947, p. 45-46.

Jig and fixture design.

24-20. Shrinkage Allowance in Die-Casting Die Design. R. L. Wilcox. *Tool & Die Journal,* v. 12, Jan. 1947, p. 68-71, 98F.

Factors influencing the extent of shrinkage that will take place in die castings produced in steel dies under pressure and under given conditions. Effects of these variable factors upon the amount of shrinkage that would normally take place under theoretical or ideal conditions. While a general, all-purpose, practical shrinkage allowance figure will prove satisfactory in designing dies for most die castings, further consideration must be given to certain very simple or extremely complicated castings to arrive at a more exact shrinkage allowance.

24-21. Mohr Circle. *Testing Topics,* v. 2, Nov. 1946, p. 1-8.

Use of Mohr circle in stress and strain analysis, explained with simple geometric and trigonometric diagrams.

24-22. Helical Gear Design. E. M. Currie. *Machine Design,* v. 19, Jan. 1947, p. 100-104.

Tooth strength and wear factors determined by testing sample gears of specified material on a special machine.

24-23. Production Processes—Their Influence on Design. Part XIX. Metallizing. Roger W. Bolz. *Machine Design,* v. 19, Jan. 1947, p. 105-110.

Applications of metallizing; procedure; avoidance of sharp edge or point bearing; spray welding with powders; design of parts; materials used; tolerances.

24-24. Reinforcement of Branch Pieces. J. S. Blair. *Engineering,* v. 162, Dec. 6, 1946, p. 529-533, 540; Dec. 13, 1946, p. 553-556.

Static bending test and vibration test results on welded pipe ties reinforced in different ways. Test result for static bending and for vibratory stressing. It is concluded that the "triform" reinforcement is most satisfactory for all types of both static and vibrational forces. (To be continued.)

24-25. Utilizing Mechanical Properties in Die Casting Design. Part IV. Members Subjected to Bending and Axial Loads (Continued.) Joseph Marin. *Die Castings,* v. 5, Jan. 1947, p. 21-22, 44.

Design of columns and short members subjected to bending and axial loads.

24-26. Cardboard Mockups. Morton P. Matthew. *Product Engineering,* v. 18, Jan. 1947, p. 120-122.

Cardboard drastically reduces limitations, and provides a medium from which accurate and detailed reproductions can be made. Methods of construction together with the characteristics and advantages.

24-27. Designing for Economy of Material, Tooling, Labor. Kenneth W. Schmidt. *Product Engineering,* v. 18, Jan. 1947, p. 132-136.

Substantial savings were realized by more economical choice of materials, requiring less machining time. Material cost tables.

24-28. Dimension and Tolerances—Fundamental Principles. Merhyle F. Spotts. *Product Engineering,* v. 18, Jan. 1947, p. 160-164.

Necessity and fundamentals of specifying tolerances. Relative advantages of unilateral and bilateral and of cumulative and noncumulative tolerancing methods. Selective assembly for parts requiring small tolerances and the use of datum surfaces.

24-29. Taper Measuring Formulas and Methods. W. Richards. *Machinery (London),* v. 69, Dec. 9, 1946, p. 786-791.

Almost all calculations and measurements required in the production of tapers and taper gages may be based solely upon the given taper per foot, or usually, upon the derived taper per unit length, or the taper per inch a side. Each method considered.

24-30. Biaxial Stresses in Rigid Vessel Simulated in Notched Tension Coupon. Given Brewer. *Metal Progress,* v. 51, Jan. 1947, p. 91-96.

Strain gage stress analysis of weld metal of a small pressure vessel showed that working loads resulted in close approach to yield point in both tangential and longitudinal directions. Shows how these stresses can be simulated and suggests use of tension impact tests at various temperatures to obtain information about the working behavior of steel in rigid structures and its transition temperature from ductile to brittle condition.

24-31. Nondestructive Measurement of Residual and Enforced Stresses by Means of X-Ray Diffraction. George Sachs, Charles S. Smith, Jack D. Lubahn, Gordon E. Davis, and Lynn J. Ebert. *Welding Journal,* v. 26, Jan. 1947, p. 26s-49s.

Tests on notched tensile bars and in the vicinity of a welded joint in aircraft steel tubing. Data on the effects of stress and degree of notching on the principal stresses and stress-concentration factors for flat notched tensile test specimens. X-ray techniques were found to be of limited value. 19 ref.

For additional annotations indexed in other sections, see: 9-3-4-6; 11-9; 12-16; 14-28-32; 19-17; 20-5-7-13-38-40-43; 21-3; 22-2-8-17-18-28-43; 23-3; 27-4-7-13-24.

25 MISCELLANEOUS

25-1. Mechanical Materials Handling Increases Output of Small Motors. *Production Engineering & Management,* v. 18, Dec. 1946, p. 66-74.

Incoming raw stock unloaded from cars, weighed and piled by one operator; parts in process moved from station to station without manual assistance; machine operations served by mechanical loading and unloading devices; assembly processes expedited by fixtures which eliminate monotonous tasks; final inspection speeded up by conveyerized hot-run testing equipment; product packaging accomplished by mechanical man-hour reducing devices.

25-2. Manufacturing Research Spearheads Drive for Lower Production Costs. *Production Engineering & Management,* v. 18, Dec. 1946, p. 87-88, 112.

Manufacturing research setup now being established by International Harvester in Chicago will serve as a center for specialized, intensive study of improved manufacturing processes and will supplement other plant research.

25-3. Present Trends in Alloys. *Petroleum Engineer,* v. 18, Dec. 1946, p. 79-80.

Development and research staff of International Nickel Co. discuss alloy steels; stainless steels; high-temperature alloys; alloy cast irons; cast bronzes; high-nickel irons; nickel plating; nickel and high-nickel alloys.

25-4. Work of the B.C. Research Council in Mining and Metallurgy. *Western Miner,* v. 19, Dec. 1946, p. 68.

Investigations in physical metallurgy and heat treatment; foundry practice; stress analysis and design; reduction metallurgy; ore dressing; ceramics; industrial mineral beneficiation.

25-5. Packaging. Part IV. Methods of Applying Water-Vapor Barriers, and the Water-Vapor Resistance of Some Packaging Materials. C. G. Lavers and Jesse A. Pearce. *Canadian Journal of Research,* v. 24, Sec. F, Nov. 1946, p. 409-419.

Water-vapor resistance and ability to withstand rough handling were investigated for a wide variety of packaging materials at room temperature and at −40° F. Laminated materials having metal foil as one layer provided the greatest protection. 11 ref.

25-6. Fisher Body Devises Aids for Pressed-Metal Handling. Part II. Rupert Le Grand. *American Machinist,* v. 91, Jan. 2, 1947, p. 86-87.

Results obtained when standardized shop trucks, skid boxes and dollies are used in subassembly operations.

25-7. Wrought Aluminum Alloy Nomenclature. O. L. Mitchell. *Aluminum and Magnesium,* v. 3, Dec. 1946, p. 13, 15, 30, 32.

Current nomenclature system for the various wrought aluminum alloys. Material is placed in chronological order so that it can be used as a handy reference.

25-8. Ordnance Department Research and Development. Al Leggin. *Chemical and Engineering News,* v. 24, Dec. 25, 1946, p. 3350-3351.

Fifth in a series on the War Department research and development program. Organization of this work and the problems being investigated.

25-9. Metallic Titanium and Its Alloys. R. S. Dean and B. Silkes. *Bureau of Mines Information Circular* 7381, Nov. 1946, 38 p.

Occurrence, methods of preparation, powder metallurgy, fabrication, properties, uses, and alloys of titanium. 256 ref.

25-10. 1947 Annual Forum on Technical Progress in Metalworking. *Steel,* v. 120, Jan. 6, 1947, p. 211-218, 220, 222, 224, 226, 231, 232, 234, 236, 239, 240, 242, 244, 251, 254, 257-260, 262, 265, 268, 270, 272, 275-278, 280-282, 285-286, 289-292, 294, 296-298, 300-302, 304, 311, 384-386.

Comments by leading authorities on recent and prospective developments relating to the production of metals and their fabrication into finished products. Sections cover metallurgy; casting; forging and forming; joining and welding; metal production; machining; equipment; heat treating; surface treatment; inspection and testing; lubrication; materials handling.

25-11. Modernized Methods at Nash Increase Production Efficiency. *Production Engineering & Management,* v. 19, Jan. 1947, p. 66-75.

How parts are fabricated and assem-

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CHAPTER MEETING CALENDAR

CHAPTER	DATE	PLACE	SPEAKER	SUBJECT
Baltimore	March 17	Engineers' Club	C. H. Lorig	Metallurgy of Cast Iron and Cast Steel
Birmingham Dist.	March 4		J. S. Donelson	Annealing and Annealing Furnace Atmospheres
Boston	March 7	Hotel Sheraton	A. B. Kinzel	Alloying Additions to Steel
Calumet	March 11	Phil Smidt & Son, Whiting, Ind.	Ladies Night	Lecture and Demonstration by Corning Glass Co.
Canton-Massillon	March 10	Elks Club, Canton, Ohio	Dr. McIntyre	Enameling
Cedar Rapids	March 11	Hotel Roosevelt	A. N. Swanson	Steel Mill Processing to Specifications
Chicago	March 13	Chicago Bar Assoc.	W. H. Holcroft	Carbo-Nitriding and Furnace Atmospheres
Cincinnati	March 13	Engineering Society	D. L. Colwell	Die Castings
Cleveland	March 3	Cleveland Club	To be announced	Sustaining Members Night
Columbus	March 11	Fort Hayes Hotel	Francis F. Lucas	High Power Metallography
Dayton	March 12	Engineers Club	D. L. Colwell	Die Casting
Des Moines	March 11	Des Moines Technical School	To be announced	New Developments in Steel
Detroit	March 10	Rackham Bldg.	J. B. Johnson	Forged, Cast or Welded Structures as Applied to Aircraft
Eastern New York	March 11	Danish Hall, Schenectady	William Dyrckacz	Recent Developments in Drop Forgings
Fort Wayne	March 10	Chamber of Commerce	Charles Lipson	Stress Analysis
Georgia	March 3		Anson Hayes	Finishing of Steel for Decorative and Corrosion Resisting Purposes
Hartford	March 11	Hartford Gas Co.	Gordon T. Williams	Selection of Steels for Engineering Applications
Indianapolis	March 17	Marott Hotel	F. S. Badger	Precision Castings
Kansas City	March 19	Union Station	F. L. La Que	Corrosion
Lehigh Valley	March 7	Hotel Bethlehem, Bethlehem, Pa.	Gregory Comstock	Industrial Application of Powder Metallurgy
Los Alamos	March 18		E. E. Thum	Metallurgical Advances, 1940-46
Mahoning Valley	March 11		L. K. Reinartz	Quality Control in the Openhearth
Milwaukee	March 18	City Club	A. R. Troiano	Transformations and Heat Treatment of Steel
Montreal	March 3	Queen's Hotel	F. L. La Que	Selection of Stainless Steels for Particular Services
Muncie	March 13	Muncie Central High School	Peter Payson	A Modern Viewpoint on the Annealing of Steel
New Haven	March 20	Conn. Light & Power Auditorium, Waterbury	J. L. Kimberly	Continuous Casting in the Nonferrous Industry
New Jersey	March 17	Essex House, Newark	Raymond A. Grange	Intensified Steels
New York	March 3	Building Trades Bldg.	G. Vennerholm	Specification and Use of Castings in the Automotive Industry
North West	March 11	Covered Wagon	W. A. Schlegel	Toolsteels and Their Heat Treatment
Northwestern Pa.	March 27	Corry, Pa.	To be announced	Use of Salt Bath in Heat Treatment
Notre Dame	March 12	Engineering Auditorium Univ. of Notre Dame	F. E. Harris	Gas Carburization
Ontario	March 7	Royal York Hotel, Toronto		Ladies' Night
Ontario	March 28	Royal York Hotel, Toronto	D. A. Nemser	Effect of Structure on Machining Steel
Ottawa Valley	March 4	Mines Laboratories	H. J. Nichols	Recent Major Developments in Welding
Philadelphia	March 28	Franklin Institute	Zay Jeffries	Looking Ahead
Pittsburgh	March 13	Mellon Institute	N. L. Mochel	Application of Materials at High Temperature
Puget Sound	March			National Officers Night
Rhode Island	March 5		Stanley P. Watkins	Selection and Use of Stainless Steels
Rockford	March 26	Hotel Lafayette	P. Payson	Annealing
Rocky Mountain Pueblo Group	March 20	Whitman Hotel	E. E. Thum	Metallurgical Advances, 1940-46
Denver Group	March 21	Oxford Hotel	E. E. Thum	Metallurgical Advances, 1940-46
Saginaw Valley	March 18	Fischer's Hotel Frankenmuth, Mich.	A. Cordiano	Powder Metallurgy
Springfield	March 17	Sheraton Hotel	S. G. Fletcher	Dimensional Stability of Tool and Gage Steels
St. Louis	March 21		John Shaw	Industrial Applications of Powder Metallurgy
Syracuse	March 4	Onondaga Hotel	A. W. Merrick	Precision Castings
Terre Haute	March 10	Indiana State Student Union Bldg.	Malcolm F. Judkins	Sintered Carbide Tipped Tools
Texas	March 17	College Inn	A. L. Boegehold	President's Night
Toledo Group	March 26		G. P. Witteman	Machinability
Tri-City	March 3		Speaker from Sherwin-Williams	Paint in Metal Finishing
Tulsa	March 11		E. I. Larson	Copper-Base Alloys
Washington	March 10	Garden House, Dodge Hotel	A. J. Williams	Seamless Tubing
West Michigan	March 17	Rowe Hotel	G. T. Motock	Metallurgical Developments in Germany
Worcester	March 12	Hotel Sheraton	James McElgin	Distortion-Free Heat Treatment
York	March 12	Lancaster, Pa.	Mr. Rose	Metallurgy in Electronics

bled and flow in a continuous and uninterrupted stream to the basic assembly line.

25-12. 34th Annual Review of Metalworking Equipment Parts and Materials. *American Machinist,* v. 91, Jan. 16, 1947, p. 117-212.

Concise, classified review of more than a thousand new products of interest to the metalworking industries.

26 STATISTICS

26-1. Steel Use by States. O. L. Johnson. *Iron Age,* v. 159, Jan. 2, 1947, p. 72-75.

Consumption of steel by strictly metalworking plants on a state-by-state basis.

26-2. World Steel Production. J. R. Hight. *Iron Age,* v. 159, Jan. 2, 1947, p. 88-95.

Of the major producers, Russia and England have maintained wartime peaks as contrasted with the 23,000,000-ton decline in the United States. German output is but a tenth of the prewar level, while France is producing at a rate equal to 50% of its 1939 volume.

26-3. Metallurgy. E. S. Kopecki. *Iron Age,* v. 159, Jan. 2, 1947, p. 96-103.

Some of the technological advances that have aroused considerable interest during the past year in such fields as high-temperature metals, high-temperature ceramics, the light metals, powder metallurgy, inspection and testing, and hardenability concepts.

26-4. Nonferrous Metals. John Anthony. *Iron Age,* v. 159, Jan. 2, 1947, p. 104-109.

Nonferrous metal industry in 1946. Supplies of most metals ran short of demand, and prices, paced by heavy foreign buying, moved sharply higher. All indications are for still higher levels to be reached in 1947. Scrap supplies, long feared as a likely drug on the market, disappeared without major effect on the major nonferrous markets.

26-5. U. S. Stockpiles. Karl Rannells. *Iron Age,* v. 159, Jan. 2, 1947, p. 116-119.

With 100 million dollars assigned for stockpiling purchases in 1946, and the probability of this sum being at least doubled in 1947, considerable caution will be required by government agencies if such purchases are not to seriously affect domestic price levels.

26-6. Ore and Coal. W. A. Lloyd. *Iron Age,* v. 159, Jan. 2, 1947, p. 126-133.

Problems of ore reserves and attempts to better the situation by means of beneficiation studies and development of foreign sources.

26-7. Scrap Supplies. T. E. Lloyd. *Iron Age,* v. 159, Jan. 2, 1947, p. 134-139.

1947 prospects.

26-8. Machine Tools. H. E. Linsley. *Iron Age,* v. 159, Jan. 2, 1947, p. 154-159.

The industry in 1946 and its prospects for 1947. Machine tool industry in the past year recorded an unspectacular 310 million-dollar sales volume. With surplus selling seen as ceasing to be a major obstacle to new sales by the end of 1947, the industry is establishing new buying interest through aggressive technological product improvement, particularly in automatic units.

26-9. Metal Finishing. Adolph Bregman. *Iron Age,* v. 159, Jan. 2, 1947, p. 160-165.

Economic and technical developments of 1946 and prospects for 1947.

26-10. Welding. H. E. Linsley. *Iron Age,* v. 159, Jan. 2, 1947, p. 166-171.

Economic and technical developments of 1946 and prospects for 1947. 10 ref.

26-11. Summarized Statistics of Production of Lead and Zinc in the Tri-State (Missouri-Kansas-Oklahoma) Mining District. A. J. Martin. *Bureau of Mines Information Circular* 7383, Nov. 1946, 67 p.

26-12. Iron Ore Reserves of the Lake Superior District. E. W. Davis. *Mining and Metallurgy,* v. 28, Jan. 1947, p. 15-18.

Future prospects. Shortage of high-grade must make some companies turn shortly to taconite concentration or imported ore.

26-13. Shortages Thwart Europe's Recovery. Vincent Delport. *Steel,* v. 120, Jan. 6, 1947, p. 312-313, 372-375.

Economic rehabilitation efforts handicapped by inadequate supplies of coal, steel, scrap and other raw materials as well as manpower crisis.

26-14. British Push Steel Industry Modernization. J. A. Horton. *Steel,* v. 120, Jan. 6, 1947, p. 314-135, 364-365.

Improvement programs proceeding with proposal to nationalize the industry temporarily shelved. Manufacturing industries make headway slowly with steel supply short.

26-15. French Industry's Progress Hinges on Coal. Leon Jaudoin. *Steel,* v. 120, Jan. 6, 1947, p. 316-317, 366-368.

Unless fuel shortages and inflation dangers are corrected, the nation's steel industry will be unable to regain its prewar status, to the detriment of dependent consuming lines.

26-16. Steel Exports to Expand as Supply Permits. B. K. Price. *Steel,* v. 120, Jan. 6, 1947, p. 318-319, 370-371.

1947 prospects, which include high foreign demand and trend toward return of foreign trade to private enterprise.

26-17. 1946 Domestic Market Summary. William M. Rooney. *Steel,* v. 120, Jan. 6, 1947, p. 320-321, 376-381.

Production and consumption statistics.

26-18. Latin America—The Possibilities of Industrialization. The United States of Brazil. *British Steelmaker,* v. 13, Jan. 1947, p. 10-19.

Mineral resources of Brazil; principal steel mills; statistical information.

26-19. Appraisal of Metalworking With a Statistical Summary. *American Machinist,* v. 91, Jan. 16, 1947, p. 101-116.

Data on machine tools and other production equipment, on output of metals, components and finished products and information on orders, wages and prices.

26-20. Foreign Ore Reserves of Copper, Lead, and Zinc. William P. Shea. *Engineering and Mining Journal,* v. 148, Jan. 1947, p. 53-58.

Comprehensive survey of foreign ore reserves, production, and requirements demonstrates that foreign ore reserves and capacities are also limited.

26-21. Notes on the Japanese Magnesium Industry. Donald L. Colwell. *Metal Progress,* v. 51, Jan. 1947, p. 67-70.

Various processes used. Tables give annual magnesium production for Japan proper, Korea, and Formosa, and examples of Japanese magnesium alloy specifications.

For additional annotations indexed in other sections, see: 27-12.

27 NEW BOOKS

27-1. Shot-Peening. 128 p., American Wheelabrator & Equipment Corp., Mishawaka, Ind. $1.50. (Free to executives addressing requests on company letterhead.)

First part of the book is devoted to the applications and advantages of shot-peening and the equipment and procedures involved. Second part covers theory of prestressed surfaces in relation to shot-peening.

27-2. Precision Hole Location for Interchangeability in Toolmaking & Production. J. Robert Moore. 448 p., Moore Special Tool Co., Bridgeport, Conn. $3.00.

Aims to help toolmakers accurately mass produce special tools, dies, fixtures, gages and molds. Includes 184 pages of tables prepared by W. J. Woodworth and Son, for laying out holes in circles. (From review in *Tool Engineer,* v. 17, Jan. 1947.)

27-3. Die Funkenanalyse und Haertepruefung in Betriebe. (Spark Tests and Hardness Tests for the Workshop.) E. Berner. 136 p., Schweizer Druck- und Verlagshaus, Zurich, Switzerland.

Intended as a guide for the shop man. The combination of the spark test with hardness testing is quite original. The Brinell, diamond pyramid, and Rockwell tests are dealt with mainly from the point of view of machines built in Switzerland. Reference is also made to Mohs' scale. Attention drawn to Rosival's abrasion tests. No reference is made to modern microhardness testing methods or to rebound testing. (From review in *Industrial Diamond Review,* v. 6, Dec. 1946.)

27-4. Toleranzen, Passung und Konstruktion. (Tolerances, Fits and Design.) H. Bradenberger. 318 p., SDV-Fachbuecher, Schweizer Druck- und Verlagshaus, Zurich, Switzerland.

Book is based mainly on the I.S.A. tolerance system, now accepted by nearly all countries using the metric system of measurement. Section "Surface Finish and Standardization" is not very up-to-date, and corresponds to what was known in 1938. Sections on tolerances for antifriction bearings seem to be particularly exclusive and good, as is that on the interrelation between tolerances and design. Special attention may be drawn to the tolerance investigation on statistical basis. (From review in *Industrial Diamond Review,* v. 6, Dec. 1946.)

27-5. Sir William J. Larke Medal Prize-winning Papers. The Institute of Welding, London. 7s. 6d.

Five papers for which prizes were awarded by the Council of the Institute of Welding in the Sir William J. Larke Medal Competition of 1944.

27-6. Thermodynamic Properties of Ammonium and Potassium Alums and Related Substances, With Reference to Extraction of Alumina from Clay and Alunite. K. K. Kelley, C. H. Shomate, F. E. Young, B. F. Naylor, A. E. Salo, and E. H. Huffman. 104 p., Bureau of Mines, Washington 25, D. C. (Technical Paper 688.)

Basic available thermal data are assembled and correlated in order to show the energy requirements and relationships involved in the clay and alunite processes for recovery of alumina from these materials.

27-7. Mechanical Drawing. Frederick Samuel Nicholson. 218 p., D. Van Nostrand Co., 250 Fourth Ave., New York, N. Y. $2.00.

A textbook for a high school course in draftsmanship for industry.

27-8. British Cast Iron Research Association Annual Report. 12 p., British Cast Iron Research Association, Birmingham, England.

Outlines research program and other activities of the association.

27-9. Phosphorus-Iron Alloys Bulletin No. 1. 36 p., Phosphate Division, Monsanto Chemical Co., St. Louis, Mo.

Results of extensive tests on low-carbon, low-alloy steels reported in charts and tables. Studies include influence of phosphorus on microstruc-

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EMPLOYMENT SERVICE BUREAU

The Employment Service Bureau is operated as a service to members of the American Society for Metals and no charge is made for advertising insertions. The "Positions Wanted" column, however, is restricted to members in good standing of the A.S.M. Ads are limited to 50 words and only one insertion of any one ad will be printed. Address answers care of A.S.M., 7301 Euclid Ave., Cleveland 3, Ohio, unless otherwise stated.

POSITIONS OPEN

East

METALLURGIST: Or engineer with met. exp. to prepare digests and abstracts of research work in the field of welded ship structures and related work on materials and welding. Also to serve as technical secretary for research committee. Some exp. in field desirable. Excellent opportunity. Salary attractive. Box 2-5.

TEACHER—RESEARCH: Technical institute desires young man with master's degree to teach courses in metal finishing and to conduct research in this field with special emphasis on electroplating. Must be prepared to teach either chemistry, physics, or mathematics also. Excellent opportunity in new program. Living accommodations available. Box 2-10.

UNIVERSITY: In New York State has openings for two metallurgists. One to do research work on sponsored materials testing projects now under way, and to develop and teach new courses. Other required primarily to develop met. eng. service courses and curriculum. Box 2-15.

FOUNDRY ENGINEER: With met. background and practical fdry. exp. Must be prepared to travel. Give age, training and exp. Box 2-20.

FOUNDRY TECHNOLOGIST: With practical exp. in the manufacture of high-quality gray iron castings. Some traveling necessary. Give full particulars. Box 2-25.

CHEMICAL ENGINEER: College grad. with exp. in general finishing processes. To act as an advisor on selection of finishes and methods for applying them. Should have knowledge of plastics and other types of synthetics. Must be keen and adaptable. Give exp. and salary desired. Send small photograph. Box 2-180.

ASSISTANT RESEARCH ENGINEER: For industrial research program at an eastern university. Should be a met. grad. Opportunity to study for M.S. or Ph.D. Box 2-185.

EXCELLENT OPPORTUNITY: For metallurgist, mechanical, chemical or electrical engineer to do sales and development work on stainless steels and nickel alloys. Recent graduates will be considered as well as those with sales, production or warehouse exp. Box 2-190.

ASSISTANT METALLURGIST: Age 24 to 30. College grad. with some mill exp. for special development work in exclusive stainless steel sheet mill located in East. State education, exp., salary expected and include small recent photograph. Box 2-195.

Midwest

METALLURGIST: To conduct research on problems involving physical process and fdry. met. of ferrous metals. Excellent opportunity for properly qualified young man with research exp. in one or more of these fields. Write today to Battelle Memorial Institute, 505 King Ave., Columbus 1, Ohio.

ENGINEER: Experienced in the design of openhearth furnaces. Arthur G. McKee & Co., 2300 Chester Ave., Cleveland 1, Ohio.

SUPERVISOR: Wire, rod and strip mill. Engineer, age 30 to 35, college degree and background in met. Exp. in wire, rod and strip practice. Stainless steel production exp. preferred. Top organization members are nearing retirement age, thus offering fine opportunity to advance to production manager. Production exp. essential. Box 2-30.

West Coast

PRESSED METAL ENGINEER: Ten to 15 yr. design and practical shop exp. with pressed metal work. To analyze parts now arranged for steel castings or welded structures and redesign for pressed metal where economical. Exp. with small as well as heavy work; hydraulic presses; crank presses; bending brakes; blanking, forming and drawing; hot and cold work. Box 2-35.

MACHINE SHOP MANUFACTURING ENGINEER: Ten to 15 yr. exp. in machine shop work. Engineering training to check designs of parts for economical manufacturing in the machine shop. Exp. with drop forgings helpful so that where possible processes can be converted to drop forgings. Box 2-40.

STEEL CASTINGS ENGINEER: Ten to 15 yr. exp. in steel fdry. To check engineering designs for good fdry. practice. Some gray iron and malleable iron used, and should know when these could be substituted for steel castings. Box 2-45.

TRAILER AXLE ENGINEER: Design engineer with 5 or more yr. design exp. with heavy motor truck or trailer axles. To supervise axle engineering division of progressive company. Box 2-50.

POSITIONS WANTED

METALLURGICAL ENGINEER: Age 26. 1 yr. in ferrous fdry., 1 yr. in research laboratory. East or West Coast or vicinity of Denver preferred. Will leave country if arrangements are satisfactory. Position in steel or gray iron fdry. preferred. Box 2-55.

METALLURGICAL ENGINEER: Age 28, married; B.S. in Met. Eng., Univ. of Ill. (1940). Recently discharged from Army. 5 yr. miscellaneous exp. in heat treatment, physical testing, chem. analysis of steels, furnace atmospheres and general met. trouble shooting. Primarily concerned with technical processing operations employed in the manufacture of ferrous and nonferrous production parts, plating, anodizing, magnetic inspection, radiography and resistance welding. Box 2-60.

FOUNDRY METALLURGIST: Age 34, married; B.S. in chem. 1933. 11 yr. exp. in production research, and development in nonferrous fdry. Important publications. Desires responsible position. New England area preferred, others considered. Box 2-65.

GRADUATE ENGINEER: 6 yr. exp. in ferrous and nonferrous met. Trouble shooting, vendor contact and applied research. Skilled at handling shop and technical personnel. 2 yr. work with high-temperature alloys including planning of a complete high-temperature testing lab. Desires supervisory position offering intellectual and financial advancement. Box 2-70.

CHIEF METALLURGICAL ENGINEER: Executive training, degree and over 9 yr. exp. in met. and eng. Exp. in steelmaking, shaping and heat treating, selection and application of materials, specifications, process engineering, metallography, investigations and contact work. Electric salt baths to 2400° F. Well qualified in theory and exp. Age 33. Box 2-75.

VETERAN: B.S. and M.S. degrees with majors in chem. and eng. 6 mo. construction eng. on underground structures. 3 yr. as educational director at CCC Camps. 3 yr. materials and met. eng., U.S. Navy yard. 3½ yr. Major in Army with duties as chief of metals inspection in a chemical warfare district. Instructor in testing of materials and heat treatment, 3 yr. Age 35, married. Southwest location preferred. Box 2-80.

METALLURGICAL ENGINEER: Veteran, age 26, B.S. in Met. Eng., married. Desires position with opportunity for advancement leading to met. contact work or process control. Some exp. in met. lab. work. No preference in location. Box 2-85.

METALLURGICAL ENGINEER: Age 32, single. Excellent background. 4 yr. teaching exp.; 2½ yr. with large, modern met. lab. involving investigation of failures in wide variety of ferrous alloys including toolsteels, stainless steels, cast irons, manganese steels. In charge of metallography and heat treating. Desires responsible position in production or research. Box 2-95.

FERRO-ALLOY SALES ENGINEERING: Wide experience in melting of stainless and high speed steels. Also openhearth exp. B.S. in Met.; age 29; married. Box 2-100.

METALLURGIST: Ph.D., internationally known. 25 yr. exp. in ferrous and nonferrous practices, including analyses, physical and mechanical testing, metallography, magnesium production, general engineering practice, heat treatments, teaching, scientific and practical researches, development work, extraction of rare metals, technical writing. Desires permanent position of major responsibility with commensurate salary. Box 2-105.

METALLURGICAL ENGINEER: 21 yr. diversified exp. Desires position as adviser to the president or vice-president in charge of operations, where a critical survey of the present metallurgical process methods will contribute to a lowering of production costs while maintaining quality. Box 2-110.

METALLURGIST: B.Ch.E.; graduate work; age 28; ex-naval officer. 3 yr. precious metal alloying, assaying and refining. 5 yr. ferrous metal processing, testing, under Ordnance Dept. Executive ability and exp. Desires position in met development or control. Vicinity of New York City preferred. Box 2-115.

HEAT TREAT SUPERVISOR: Age 32; 4 yr. college work. 12 yr. diversified industrial exp (mostly commercial shops). Knows tool and di hardening. Acquainted with modern procedures. Exp. in heat treatment recommendations, production control and shop problems. Progressive, efficient. New York—New Jersey area preferred. Box 2-120.

METALLURGICAL ENGINEER: Age 29, married. B.S. Met. Eng., grad. work in mech. eng 1 yr. exp. as metallurgical observer and 5 yr. exp. as metallurgist in naval lab. Exp. largely with low-alloy high-strength structural steels. Desires position as plant met. engr. in Pittsburgh area. Box 2-125.

TECHNICAL WRITER AND SPEAKER: Grad. met. eng. with 10 yr. of industrial exp., ferrous and nonferrous. Exp. in plant, lab., engineering and teaching. Professor of met. Solid background in technical writing and lecturing. Desires position as technical writer and/or speaker. Box 2-130.

METALLURGIST: Age 28; B.S. in chem. 3½ yr. exp. with aluminum, magnesium and zinc alloys, frdy., physical testing, metallography, heat treating and research. 2 yr. exp. on surface treatment of metals. Desires position with opportunity for learning and advancing. Midwest location. Box 2-135.

METALLURGICAL ENGINEER: Mature. B.S. in Eng. Broad exp. in steel, gray iron, and nonferrous fdry., testing, heat treating, carburizing, plating, galvanizing, centrifugal precision casting, openhearth, arc and induction melting, cupola practice, metallography, radiography, research design, inspection, materials specifications, chill molds. Available soon. Box 2-140.

METALLURGICAL ENGINEER: Married; B.S. plus post grad. work. 5½ yr. extensive exp. including steel mill production, welding development, industrial research, fdry., and allied fields. Supervisory and organization work. Desires responsible position as plant metallurgist. Box 2-145.

METALLURGIST: Age 27, B.S. in met. eng. Recently discharged veteran. Approximately 3 yr. broad exp. in plant and lab. as assistant metallurgist. Desires permanent position with steel firm or forge shop. Box 2-150.

ENGINEER: B.S. met. eng.; Univ. of Washington, 1941. Age 31, married. 2 yr. exp. in mfg. and steel mill control labs. 4 yr. exp. in maintenance and operation of electrical and magnetic equipment, mostly administrative and supervisory. Desires position with responsibility in industrial engineering or installation. Western or foreign location. Box 2-155.

METALLURGICAL ENGINEER: B.S. in met. with considerable grad. work. Well versed in the modern technical approach to most met. aspects of mfg. Successful relations with technical and nontechnical personnel during 10 yr. engineering activity with large midwest manufacturer. Box 2-160.

METALLURGICAL ENGINEER: Age 26, M.Sc., married. 4 yr. extensive experience—some supervisory—relating to production contact, quality control, parts failure study, heat treatment, fdry., machine shop, research, and report writing. Desires responsible engineering or manufacturing position in nonbasic industry. Box 2-165.

METALLURGICAL ENGINEER: Age 28; B.S. degree. 6 yr. industrial exp.; 3 yr. physical met. research and development; 3 yr. production and plant trouble shooting. Desires position in development or plant met. work. East preferred. Box 2-170.

METALLURGIST: B.S. met. eng. 7 yr. exp. 5 yr. trouble shooting related to welding, forming, heat treating, casting and forging in ferrous and nonferrous fields. Supervised met. and physical testing lab. 1 yr. research metallurgist in ferrous and nonferrous precision casting plant; 1 yr. supervision of same. Box 2-175.

RESEARCH ENGINEER: Age 27. Master Met. Eng. 3 yr. lab. research on arc welding. 1 yr. exp. as welding engineer engaged in repair work, development of welding procedures, evaluation of electrodes, automatic welding, testing and inspection. Desires position as research engineer in industrial lab. engaged in met. or welding research. Box 2-200.

METALLURGIST: Age 30, married; B.S. in Chem. Eng. 8 yr. varied met. exp. Formerly chief metallurgist at aircraft company, in charge of selection of ferrous and nonferrous alloys and development of materials and processes. Desires position in development or plant met. $4200 minimum. Box 2-205.

METALLURGICAL — MECHANICAL ENGINEER: Age 25, married; 4½ yr. college, B.S. in Phys. Met. 4 yr. met. and eng. exp., 2 yr. at Los Alamos. Exp. in mech. testing, alloy development, nonferrous fabrication, powder met., metallography and supervisory work. Desires permanent position at good pay in the West, preferably Los Angeles or San Francisco area. Box 2-210.

METALLURGIST: 14½ yr. exp. ferrous and nonferrous met. Last 4 yr. as chief metallurgist. Research, development and industrial. Age 37, married. Box 2-215.

ture; physical properties, oxidation and scaling, and electrical properties of phosphorus steels.

27-10. Electric Furnaces in Ferrous Metallurgy. N. V. Okorokov. 440 p., State Scientific-Technical Publishing House for Ferrous and Nonferrous Metallurgy, Moscow, U.S.S.R. (In Russian.)

Intended mainly for students but should be useful also to metallurgical engineers. Covers all types of electric furnaces in operation in U.S.S.R. and abroad, indicating their main characteristics, and advantages and disadvantages when applied to different metallurgical processes. Structural designs, electrical equipment and theoretical bases for calculation and design.

27-11. The Diffraction of X-Rays and Electrons by Free Molecules. M. H. Pirenne. 160 p., Cambridge University Press, New York. $3.50.

Gives theory and information obtained by use of these methods concerning the structure of atoms and molecules. Special attention is given to hypotheses and principles underlying theories, as well as to their limits of validity. Mathematical formulas and numerical data of importance are included, but extensive mathematical developments have generally been omitted. Complete bibliography of X-ray diffraction by gases. 187 ref.

27-12. Standard Metal Directory. Edition 10, 1946, 852 p., Standard Metal Directory, New York. $10.00.

Revised directory of iron and steel plants, ferrous and nonferrous metal foundries, metal rolling mills, smelters and refiners of nonferrous metals. Includes lists of fabricators of bars, sheets, tanks, plates and structural shapes, as well as storage-battery manufacturers, sheet-metal stamping works, solder manufacturers, galvanizers, and scrap-metal dealers.

27-13. Ressorts, Etude Complète et Méthode Rapide de Calcul. (Springs, a Complete Study and Rapid Method of Calculation.) C. Reynal. Edition 4. 253 p., Dunod, Paris.

A detailed analysis of the design and action of the various kinds of springs—laminated, helical, spiral, multiple—and of spring washers. The last two chapters contain certain observations on springs in general and describe two special slide rules for making rapid calculations in spring design. (From review in *Mechanical Engineering*, v. 69, Jan. 1947.)

27-14. Metallurgical Materials, Alloys and Manufacturing Processes. V. N. Wood. Chapman & Hall, Ltd., 37 Essex St., London, W.C.2, England. 25s.

Principles of the metallurgy of the common engineering materials, their properties, treatments and manufacture. Deals with manufacture of iron and steel, mechanical testing and physical examination of metals, industrial control and measurement of temperature, heat treatment and mechanical working of steel, and carbon and alloy steels. Cast iron, malleable cast iron, and the nonferrous metals and alloys are also covered, as well as welding, galvanizing, centrifugal casting, chilled castings, and powder metallurgy. Profusely illustrated. (Review from *British Steelmaker*, v. 13, Jan. 1947.)

27-15. Controlled Atmospheres for the Heat Treatment of Metals. Ivor Jenkins. Chapman & Hall, Ltd., 37 Essex St., London, W.C.2, England.

Attempts to bridge the gap between academic and practical aspects and to promote a more general recognition of the fundamental principles underlying controlled atmosphere processes and the means of translating those principles into practice. The book is divided into three sections: generation, purification and industrial application. (Review from *British Steelmaker*, v. 13, Jan. 1947.)

27-16. Symposium on Atmospheric Exposure Tests on Nonferrous Metals. 145 p., American Society for Testing Materials, 1916 Race St., Philadelphia 3, Pa.

Six papers and their discussions present data resulting from tests carried on over a ten-year period. The resistance of rolled zinc, nickel and monel, copper, lead and tin, and aluminum-base alloys to atmospheric corrosion is covered in the first five papers. The last paper describes the use of statistical methods in evaluation of the corrosion test data, and the discovery of reasons for erratic variations in the data. Appendices contain pertinent excerpts from previous reports.

27-17. Symposium on Materials for Gas Turbines. 199 p., American Society for Testing Materials, 1916 Race St., Philadelphia 3, Pa. $3.00.

Five extensive technical papers and three other papers on related subjects in the field of high-temperature materials. The mechanical properties and corrosion resistance of numerous high-temperature alloys were studied in this series. One paper also reports fundamental studies of ceramic materials for high-temperature service. Includes discussions.

27-18. Pipe in American Life. 48 p., Committee on Steel Pipe Research, American Iron and Steel Institute, 350 Fifth Ave., New York.

Historical background and modern uses of metal pipe, with emphasis on the use of steel pipe. Chapters are devoted to uses of steel pipe in homes, large buildings, process industries, railroads, shipping, mining, water-supply systems, the oil industry, the gas industry, refrigeration, irrigation, and on farms.

27-19. Heat Treatment of Metals. E. Brooker, G. B. Berlien, George M. Huck, E. R. Mertz, William F. Nash, Jr., Edward E. Fess, H. B. Osborn, Jr., E. S. Davenport, Max Tatman, S. R. McBride. 178 p., American Society for Metals, 7301 Euclid Ave., Cleveland 3, Ohio. $3.00.

A series of educational lectures given to the Los Angeles Chapter, A.S.M., include discussion on why heat treat, how to heat treat, results from heat treatment, why steel hardens, hardenability, practical applications and use of hardenability, induction heating, isothermal transformation in steel, improved treatments of aluminum alloys, and practical application of heat treated light metal alloys.

27-20. Talks About Steelmaking. Harry Brearley. 236 p., American Society for Metals, 7301 Euclid Ave., Cleveland 3, Ohio. $3.50.

A pioneer steelmaker writes of the various processes employed in making steel during his experience. Discusses molten steel, melting processes, forging, testing steel, notch fractures, specifications, clean steel, scrap control and reclamation.

27-21. Jigs and Fixtures for Mass Production. Leland A. Bryant and Thomas A. Dickinson. 222 p., Pitman Publishing Corp., 2 West 45th St., New York 19, N. Y. $3.50.

Plastics, pneumatics and hydraulics as applied to tooling. Important wartime developments such as the master tooling dock. History of the subject and how it is related to industry as a whole. Designing and construction of jigs and fixtures; various types and tooling procedures.

27-22. Definition and Measurement of Gloss. V. G. W. Harrison. 145 p., Printing and Allied Trades Research Association, Charterhouse Square, London, E.C.1, England. 10s.

Study of the literature on gloss and luster, assessing present state of our knowledge on this subject. Physical, physiological, and psychological factors influencing our sensations of gloss or luster. Various methods of gloss measurement that have been tried.

27-23. Elements of Mining. George J. Young. 755 p., Fourth Edition, McGraw-Hill Book Co., Inc., 330 W. 42nd St., New York 18, N. Y. $6.50.

Comprehensive view of mining problem emphasizing fundamental engineering principles, cost analyses, dimensional data established by mining practice. Restricted to underground methods of mining unstratified mineral deposits. Material revised since previous edition to cover present-day practice.

27-24. Machine Design. Louis J. Bradford and Paul B. Eaton. 283 p., Fifth Edition, John Wiley and Sons, Inc., 440 Fourth Ave., New York 16, N. Y. $3.25.

Progress in the field since previous editions. New information on fatigue of metals, current theories on the nature of friction and lubrication, and special precautions necessary in designing parts made of aluminum. Bearings and sliding surfaces, friction clutches and brakes, toothed gearing, belts and chains are typical chapter headings.

27-25. 1946 Plating and Finishing Guidebook. Nathaniel Hall and G. B. Hogaboom, Jr. 15th Edition, 268 p., Metal Industry Publishing Co., 11 West 42nd St., New York 18, N. Y. $1.00.

Handbook for the metal finisher. Formulas of plating solutions. Methods for testing coatings and analyzing plating solutions. Sections on surface treatments, metallizing nonconductors, stripping metallic coatings, and organic finishing.

27-26. Reynolds Aluminum Alloys and Mill Products. 248 p., Reynolds Metals Co., 2500 So. Third St., Louisville 1, Ky. $2.00.

Handbook of data outlines history of aluminum, characteristics and properties of the metal, various forms of stock and how each is fabricated. 108 tables.

27-27. Welding Aluminum and Aluminum Alloys. 87 p., Reynolds Metals Co., 2500 So. Third St., Louisville 1, Ky. $1.00.

Metal-arc welding, carbon-arc welding, atomic-hydrogen welding, inert-gas-shielded welding, oxy-acetylene welding, torch, furnace and dip brazing and various forms of resistance welding as used today on aluminum and aluminum alloys. General characteristics of aluminum which affect welding practice and weldability. Metal preparation and inspection of aluminum welds. Profusely illustrated.

27-28. Plastic Molds. Gordon Thayer. Third Edition. Huebner Publications, 2460 Fairmount Boulevard, Cleveland 6, Ohio. $5.00.

Design, manufacture and use of molds. Compression mold types classified for study; transfer and jet molding; injection molds; mold sinking; applications of mold base standards; molding of screw threads. Finishing methods and equipment, including tools, machines and accessories. Plastics tooling.

27-29. Practical Color Simplified. William J. Miskella. 128 p., Miskella Infra-Red Co., East 73rd and Grand Ave., Cleveland 4, Ohio. $5.00.

Handbook on color choosing, mixing, harmony, matching, lighting, photography, designation, pigments, testing, color in business. Patented color chart helps in selection of colors, mixing shades and tints, and harmonizing colors.

27-30. Infrared in Industry. William J. Miskella. 64 p., Miskella Infra-Red Co., East 73rd and Grand Ave., Cleveland 4, Ohio. $2.00.

A handbook on baking ovens for paints, textiles, chemicals, plastics, adhesives, written for the user, producer and salesman. Infrared in the spectrum; insulation; engineered appliances; infrared lamps; lamp spacing; how paints are baked; temperatures; advantages of infrared; portable frames; drying time table.

Solution to Shop Problems Proves Engineer's Ability

Reported by G. F. Kappelt
Assistant Metallurgist
Bell Aircraft Corp.

The worth of the metallurgical engineer is measured by his ability to solve shop problems even though the engineer himself would undoubtedly prefer to confine his activities to pure science problems. To illustrate this hypothesis, E. S. Rowland, research metallurgical engineer of the Timken Roller Bearing Co., in his talk on "The Practical Applications of Physical Metallurgy" before the Buffalo Chapter ⊕, gave four examples of problems with which he has had experience.

Dr. Rowland explained how laboratory investigation (*a*) speeded up the annealing of 52100 steel, (*b*) showed up certain flaws in the use of hardenability data, (*c*) provided an explanation of file-soft skins on hardened carburized samples, and *(d)* developed a heat treatment method for determining the exact carbon penetration in carburized samples.

Annealing Speed Increased

In annealing the 52100 steel, Dr. Rowland showed that the most critical phase of the process is the speed at which the steel is heated through the critical range. In order to obtain a minimum Brinell hardness of 170 to 187, this steel cannot be heated through its critical range at a speed in excess of 10° per hr.

Discussing hardenability, Dr. Rowland showed how prior structure affects the Jominy curve. If sufficient time at heat is not given to specimens hardened from the annealed condition, the hardenability curve will increase with increasing quenching temperature. A well-normalized structure does not show this phenomenon. From such curves and from absolute values obtained with several steels, Dr. Rowland showed how the laboratory might report a certain hardenability range and the shop yet be unable to develop the expected hardness.

Dr. Rowland then pointed out the possibilities of having a file-soft, low-hardness skin after carburizing. Such a condition is often caused by too high a carbon content resulting from low hardenability in the presence of excess carbides.

Timken has developed a system for the metallographic determination of carbon penetration depth. The system revolves around a martempering operation on the carburized sample. Time and temperature of the elevated quench must be controlled carefully, but the results are well worth the trouble. This method produces a clear-cut line that can be accurately measured even by an inexperienced observer.

Technology of Aluminum & Magnesium

(Continued from page 8)

purity aluminum-copper and aluminum-magnesium alloys are also subject to this defect—perhaps more so than the magnesium alloys. Surprisingly enough, the effect of the microporosity on the tensile properties depends somewhat upon the composition of the magnesium-base alloy (3-45, April 1946). While the high-zinc alloys, such as AZ-63, are more susceptible to microporosity than the low-zinc alloys, A8 and AZ-91, the latter two are more adversely affected by a given amount of microporosity.

Grain refinement of magnesium casting alloys has also been given considerable attention (3-39 and 4-53, 1945 volume; 4-33, May 1946; 14-152, June 1946). The classical method of refining the grain has consisted of superheating the magnesium melt immediately before pouring it into the sand molds. Recent investigations have shown that grain refinement can be obtained by the introduction of various carbonaceous materials, either the carbon-containing gases such as CO_2, propane, and natural gas, or carbonaceous solids such as powdered graphite or charcoal, various carbides or hydrocarbon. Some of these methods are not too reliable, and combination metal treatment, whereby cleaning, degassing, and grain refinement are obtained in one operation, has been described (14-84, April 1946). The magnesium alloy and scrap are melted down in the usual way, employing a flux to avoid oxidation. Chlorine is passed through a bath of carbon tetrachloride maintained at a temperature of 80 to 85° F., a small portion of which is carried over into the melt. The mixture of chlorine and carbon tetrachloride vapor is introduced below the surface through a carbon tube, and cleans the melt by removing suspended dross particles, degasses it by removing dissolved hydrogen, and refines the grain by carbon absorbed from the carbon tetrachloride. This method is being used on large-scale commercial operations. It eliminates the necessity of refining by stirring in salt fluxes, of superheating, and of excessively high temperatures. It was also suggested that this refining method could be combined with the scheme of pumping the molten metal from furnace to ladle—or even mold—as is done in ingot casting shops.

WESTERN METAL CONGRESS AND EXPOSITION
Oakland, Calif., March 22-27, 1947

MATERIALS INDEX

The following tabulation classifies the articles annotated in the A. S. M. Review of Current Metal Literature according to the metal or alloy concerned. The articles are designated by section and number. The section number appears in bold face type and the number of the article in light face.

General Ferrous

1-1-5; **2**-1-5-6-10-11; **3**-11-20-23; **4**-5; **5**-4; **6**-9-14; **7**-25; **9**-6; **10**-1-2-8-12; **11**-11; **12**-21; **16**-3-4-5-8-9-11; **22**-54; **23**-14-21; **26**-1-2-12; **27**-10-18-20.

Cast Iron

4-6; **6**-2; **7**-31-37; **9**-1; **14**-8-13-14-15-26-32-34; **18**-4-5; **20**-12-26; **23**-3; **25**-3; **27**-8.

Cast Steel

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Wrought Carbon Steel

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Alloy Steel

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Stainless and Heat Resisting Steel

4-1; **6**-1-13; **7**-36; **13**-5; **19**-3-10-34; **20**-10-12; **22**-7-9-10-23-24-34-46-49; **23**-7; **25**-3; **27**-17.

Toolsteel and Carbides

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Aluminum

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Magnesium

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Copper, Brass and Bronze

1-4-10; **2**-9; **3**-3-21; **4**-2-7; **5**-1; **6**-4-8; **15**-1; **20**-2-11-12-33; **21**-2; **22**-4-11; **23**-15; **25**-3; **26**-20.

Nickel and Nickel Alloys

3-2-20; **6**-1-9-14; **8**-1-2-5-7; **13**-5; **22**-24; **25**-3.

Lead and Lead Alloys

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Tin and Tin Alloys

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Zinc and Zinc Alloys

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Miscellaneous and Minor Metals

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Aborn Named Asst. Dir. of U. S. Steel Research Lab.

Robert H. Aborn has been appointed assistant director of the United States Steel Corp. Research Laboratory at Kearny, N. J. Dr. Aborn has been with the Kearny laboratory since 1930. He received his Bachelor's degree at Grinnell College, Iowa, and his D.Sc. at Massachusetts Institute of Technology.

R. H. Aborn

He has worked in the blast furnace department of Bethlehem Steel Co., at Watertown Arsenal, and as instructor at the engineering school at Harvard University. Dr. Aborn was awarded the Lincoln Medal of the American Welding Society in 1941, and served on the War Metallurgy Committee of the Office of Scientific Research and Development for one year during the War. He is currently a member of the A.S.M. Publication Committee.

Corporation Organized

Dr. Johan Bjorksten, owner of Bjorksten Laboratories, announces that he is forming a corporation under the name of Bjorksten Research Laboratories. This corporation will continue and expand the business of Bjorksten Laboratories.

The officers of the corporation are Johan Bjorksten, president and treasurer; Stuart O. Fiedler, vice-president; and A. Charles Lawrence, secretary. As president of the corporation, Dr. Bjorksten will continue directing the affairs of the organization. Mr. Fiedler will continue his duties as manager of the South Chicago branch laboratory.

Seven Metals Mined In Manitoba Listed

Reported by A. W. Crossley
Trans-Canada Airlines

While the history of the search for metals in the Province of Manitoba dates back about 50 years, it was not until 1930 that Manitoba became a substantial producer of metals.

Speaking on "The Mining of Metals in Manitoba", J. S. Richards of the Department of Mines and Natural Resources, said before the November meeting of the Manitoba Chapter that the metals which are presently the basis of profitable mining enterprises in the province are copper, zinc, gold, silver, cadmium, selenium and tellurium. Gold exploration has resumed with the lifting of wartime restrictions, new fields are being located and old ones checked for occurrences of merit.

The presence of many other metals has been established but the discoveries to date have either lacked tonnage or have been of marginal grade. This list of metals includes molybdenum, tungsten, tin, manganese, chromium and beryllium. Some of these will require new techniques of recovery, others may be obtained as byproducts of the processing of associated metals. Two other metals which are the subject of present investigations are lithium and nickel.

Talks on Precision Casting

Reported by R. B. Miclot
Lunex Co.

Operations necessary to manufacture precision castings were illustrated by means of slides at a joint meeting of the Tri-City Chapter and the Rock Island District American Dental Association. John A. Gallaher, district manager of the Haynes Stellite Co., Chicago, told how a white-metal die is prepared from a master pattern, and into the impression of this die wax is forced. The wax pattern, which is a replica of the master pattern, is then used to produce the investment mold. Molten metal is poured in the mold and air pressure is applied on the poured metal to insure a sound, dense casting.

Mr. Gallaher displayed many precision cast parts and discussed their applications. Against their high cost of production, he said, we should weigh the elimination of many machining, grinding, and heat treating operations.

Schreiner Awarded New Post

G. Reed Schreiner, formerly advertising manager of Carnegie-Illinois Steel Corp., has been appointed assistant director of advertising of United States Steel Corp. to succeed Reese H. Price. Robert J. Wilcox becomes acting advertising manager for Carnegie-Illinois, succeeding Mr. Schreiner.

NEW PRODUCTS IN REVIEW

CEMENT, POLISHING WHEEI

New grain cement and thinner is a welcome addition to plating supplies in these days of glue shortages. This material is an improved adhesive for polishing wheels which overcomes the deficiencies of organic glues. It has been used in the field for a number of months with complete success.

HANSON-VAN WINKLE-MUNNING CO.,
Matawan, N. J.
Mention R-237 for Reader Service

CLEANING

"Production and Maintenance Cleaning" is a new handbook giving complete information on proper methods and compounds for use in every type of production line cleaning as well as maintenance cleaning. It is bound in a handy, pocket-size booklet.

Included are recommendations for alkali cleaners, elctrolytic cleaners, emulsion cleaners, paint and enamel removers, rust removers, carbon removers, bright dips, burn-off and vapor solvent degreasing. In addition, proper compounds and dilutions are recommended for every type of maintenance cleaning, such as hand soap, floor cleaner, steam cleaner, carbon remover, rust remover, drain cleaner and many others with special industrial applications.

PHILLIPS CHEMICAL CO.,
3400-70 Touhy Ave.,
Chicago 45, Ill.
Mention R-238 for Reader Service

CLEANING, BLAST

Addition of a 48-in. Wheelabrator swing table to the standard line of Tumblasts and tables is announced. The new machine, several of which have already been built and tested, is equipped with one 19½ x 2½-in. airless Wheelabrator blast cleaning unit and is ideally suited for cleaning large, bulky, fragile work such as would normally require an airblast room. Descriptive literature and catalogs available on request.

AMERICAN WHEELABRATOR & EQUIPMENT CORP.,
Mishawaka, Ind.
Mention R-239 for Reader Service

COATING, PHENOLIC RESIN

Phenoglaze, a phenol-formaldahyde protective coating manufactured in England for use on all types of metal products, is now available to fabricators in this country.

Exacting tests have established that this plastic film is impervious to heat, moisture, and chemical action such as that of salt, gasoline, oil, alcohol, turpentine, acetone, and other corrosive agents. Phenoglaze is applied by spray, brush, or dipping. It comes as a clear coating and also in colors. Its high resistance to galvanic influences, to acids and alkaline solutions, makes it an exceptionally valuable finish in the manufacture of such products as furniture, station wagon bodies, steel boats, and radio cabinets. It is air drying and cold setting.

PHENOGLAZE SALES CORP.,
315 Broadway,
New York 7, N. Y.
Mention R-240 for Reader Service

COATING, PLATING RACK

An odorless, noninflammable plastic rack coating which can be applied in any plating plant without special precautions is known as Pen-Kote 590. This material consists of an aqueous dispersion of Saran plastic and contains no organic solvents. It is tough, flexible and highly resistant to all plating and cleaning solutions, including chlorinated degreasing solvents. It is applied by hand dipping and dries in less than an hour at room temperature, giving complete protection in 24 hr. Because it is an aqueous dispersion rather than a solution, it is exceptionally free-flowing, draining rapidly without forming webs or strands to be trimmed off after dipping.

This new material has had months of service in plating plants of all types and is now available nationally. Platers may send a sample rack to be given a free trial coating.

PENINSULAR CHEMICAL PRODUCTS CO.,
Van Dyke, Mich.
Mention R-241 for Reader Service

CORROSION RESISTING EQUIPMENT

New 20-page general bulletin gives a description of each type of corrosion resisting equipment provided by the company. Information on new alloys and equipment recently developed is included, as well as a list of processes in various industries in which Durco equipment handles chemical corrosives.

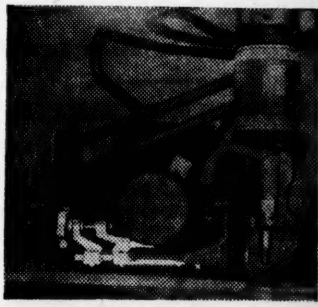
The bulletin describes production facilities of the company and explains the composition and applications of Duriron, Durichlor, Durimet and Chlorimet, the main corrosion resisting alloys of which the company's products are made. Equipment described includes: Model 40 Durcopumps; valves of many types, including plug, Y, check, angle, float, foot, relief and mechanically operated models; the new Durco 4H and 4C heat exchangers; split-flanged pipe and fittings; bell-and-spigot pipe and fittings; mixing nozzles; steam jets; immersion tubes; ejectors, tank outlets; kettles; tanks; exhaust fans. The bulletin tells what Durco alloys each piece of equipment is available in and gives sizes and capacities.

THE DURIRON CO., INC.,
Dayton 1, Ohio.
Mention R-242 for Reader Service

CUTTING, OXY-ACETYLENE

New attachment makes oxy-acetylene circle cutting possible to the extreme edge of a plate, and in the corner of any plate. This accessory for the Oxweld CM-16 portable shape-cutting machine is known as the under-the-motor circle-cutting attachment. Its main advantage is that metal can be utilized that would ordinarily have to be scrapped.

The attachment makes it possible for the standard CM-16 cutting machine



to cut circles from 2½ to 9 in. in radius. The radius of the circle to be cut is regulated by means of an adjusting screw. Circles above 9 in. in radius can be cut to the extreme edge of a plate without the attachment. The attachment is easy to install and once in place, normal cutting procedures are followed.

THE LINDE AIR PRODUCTS CO.,
30 East 42nd St.,
New York 17, N. Y.
Mention R-243 for Reader Service

ELECTRODES, ARC

New Page electrode produces machinable welds on cast iron. The soft weld metal deposited by Ni-Cast shielded arc electrodes bonds perfectly with all grades of cast iron, making it unexcelled for repairing broken or worn castings and casting defects, and for correcting errors made in machining. After machining or grinding, the weld metal deposit closely matches the color of the cast iron parent metal.

Special core wire with a nickel content of over 99% has a coating which is free of fluorides and other ingredients which generate injurious gases. Ni-Cast shielded arc electrodes have a quiet, stable arc free from spatter with a minimum of penetration and heating of the cast iron. The weld metal deposit will be sound, homogeneous and free from porosity on all grades of cast iron, while the fusion zone of the casting will be free from hard zones of white iron. The weld metal will be free from cracks or cross checks when multiple passes are used in the repair or fabrication of cast iron parts. Welds are also free of leaks on castings subject to hydrostatic pressures without using any special welding techniques

NEW PRODUCTS IN REVIEW

or processes. The deposit and the fusion zone of the cast iron may be easily machined, ground or filed.

Ni-Cast shielded arc electrodes can be used with alternating current or with either polarity direct current. Best results are obtained with direct current straight polarity for the arc is then less penetrating and there is a minimum of dilution of the base metal and the parent metal. It is manufactured in $\frac{3}{32}$, $\frac{1}{8}$ $\frac{5}{32}$ and $\frac{3}{16}$-in. diameters and is packed in 10-lb. cartons.

PAGE STEEL & WIRE DIV.,
American Chain & Cable Co., Inc.,
Monessen, Pa.

Mention R-244 for Reader Service

ELECTRODES, AUTOMATIC

Una automatic wires and Una tapes have been added to Wilson's line of manual electrodes. Five knurled-type wires and five flux-impregnated tapes comprise the present line, all highly recommended for low-cost, yet uniform, automatic welding. Designed for flat position operation, their applications on the assembly line are many and varied, ranging from thin gage sheet metal forms to axle housings, boilers and torque tubes.

Subjected to continuous laboratory and field tests in order to assure highest quality results, Una automatic wires and tapes have been in constantly increasing demand since their introduction to industry. Meeting the requirements for high-speed fabrication, they are now available in several diameters and alloy analyses. Depending upon the application, the automatic wires may be used separately or in conjunction with the tapes.

WILSON WELDER AND
METALS CO., INC.,
60 East 42nd St.,
New York 17, N. Y.

Mention R-245 for Reader Service

FILTERS, OIL

New bulletin covers the use of both pressure and gravity filters for coolants and cutting oils. Directed to both manufacturers and users of all types of machine tools, the bulletin describes ways and means for conserving oils, as well as for protecting cutting tools against excessive wear. Filters are available for installation as original equipment on new machine tools, or as separately connected units on existing machinery.

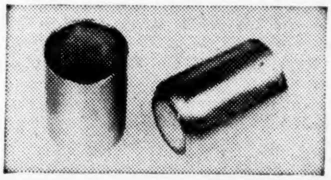
WM. W. NUGENT & CO., INC.,
410 N. Hermitage Ave.,
Chicago, Ill.

Mention R-246 for Reader Service

FILTERS, STAINLESS STEEL

Production of stainless steel laboratory filters with porous stainless steel filter elements includes filter crucibles, Buchner funnels, gas dispersion tubes and filter tubes.

These laboratory filters are made by welding the porous stainless steel filter element into carefully designed solid



stainless steel filter bodies. In addition to freedom from breakage, the filters can be heated and cooled without danger of cracking. They are light and uniform in weight. Higher flow rates for any given pore size are obtained. In addition to resistance to many acid conditions, the funnels are completely resistant to alkali attack. The Buchner funnels are normally used without a paper covering, but the coarser grades may also be covered with a filter paper, under which conditions higher flow rates are obtained than with perforated Buchners since the whole area of the filter paper is

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Metals Review, February 1947

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utilized, rather than the section just above the holes. Availability of industrial filter units made up with the same filtering material is a great advantage in the application of the new filters to research and development work.

The filter crucibles may be used for the gravimetric analysis of all the common elements. Filter crucibles and Buchner funnels are also useful in accomplishing separations. Gas dispersion tubes are constructed in such a way that the whole volume of liquid may be filled with fine bubbles. The filters are available in five porosities ranging from very fine to very coarse.

MICRO METALLIC CORP.,
193 Bradford St.,
Brooklyn 7, N. Y.
Mention R-247 for Reader Service

FORGINGS, NONFERROUS

Featured in the September issue of the *Non-Ferrous Forgings Digest* is an article discussing the incrased use of forgings made of brass, bronze and aluminum by the automotive industry. Some of the advantages of using the forging process in fabricating various unusual and intricate parts are presented together with many illustrations of typical forgings of nonferrous metals. This material will be of interest to design and production engineers not only in the automotive field but in industry at large.

Included in this issue is the first part of a glossary of terms commonly used in connection with nonferrous forgings. This glossary will be continued.

THE BRASS FORGING ASSOCIATION,
420 Lexington Ave.,
New York 17, N. Y.
Mention R-248 for Reader Service

ADVERTISERS INDEX

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7301 Euclid Ave., Cleveland 3, Ohio
ENdicott 1910

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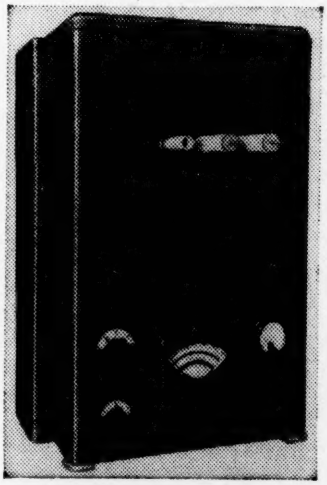
Don Harway, West Coast Representativ
816 West 5th St., Los Angeles 13
Mutual 6331

68 Post St., San Francisco 4
Y ukon 6-106 9

FURNACE, LABORATORY

New high-temperature laboratory combustion furnace marketed under the trademark of Hitemp furnace may be used as a single, double, or triple-tube unit. A maximum high operating range of 2900° F. anticipates any future increase in temperature used to burn heat resisting alloys.

This furnace was designed for the industrial laboratory where simplicity of operation and low maintenance are of prime importance. It comes as an



integral unit, ready to plug into the 220-volt outlet, complete with power supply, ammeter, rotary power selection switches, heating elements, automatic temperature control and thermocouple. A combination disconnect switch and circuit breaker is provided which automatically protects the furnace against overloads. An electronic automatic temperature controller is furnished.

Six ¾-in. diameter heating elements provide a radiating surface area of 128 sq. in., insuring a long, useful heating element life.

The insulation of the furnace has been designed in accordance with the well-known principles of heat transfer. The interior of the furnace chamber is lined with insulating firebrick which will withstand a maximum temperature of 3000° F. The outer layer of insulating material is 1½ in. of Superx block. The total furnace wall thickness is 6¼ in.

HARRY W. DIETERT CO.,
9330 Roselawn Ave.,
Detroit 4, Mich.
Mention R-249 for Reader Service

HONING

Latest developments in honing techniques are presented in eight-page reprint of paper presented by L. S. Martz and D. T. Peden at a recent S.A.E. meeting. Modern honing provides greater economical control and reproducibility of the final processing result than has been possible, removing the desired amount of metal rapidly and selectively as may be required to correct errors and to generate close tolerance, geometric accuracy and final size.

MICROMATIC HONE CORP.,
8100 Schoolcraft Ave.,
Detroit 4, Mich.
Mention R-250 for Reader Service

TESTING, TRANSVERSE

Catalog page describes new model transverse testing machine with 10,000-lb. capacity. It is identified as Model TR-1. Other types of Steel City machines include six different models of Brinell testing machines comprising manually operated and portable types; also a universal model that may be adapted to tensile, traverse and compression tests up to 60,000 lb. Complete catalog consists of 20 pages.

STEEL CITY TESTING MACHINES, INC.,
8843 Livernois Ave.,
Detroit 4, Mich.
Mention R-251 for Reader Service

THERMOCOUPLE

Better heat treating can be obtained at reduced cost with this new thermocouple of improved design, it is said. Supplied with either standard chromel alumel or iron constantan element, they can be used with any make of pyrometer. Closer temperature control is obtained by the use of a ⅞-in o.d. heavy seamless drawn Inconel protecting tube which fits the thermocouple element closely for maximum sensitivity of response. This is particularly advantageous on automatic control installations.

Long life is assured by the unusually heavy wall thickness (0.147 in.) of the protecting tube, and the 80% nickel, 13% chromium high grade ductile alloy eliminates porosity and mechanical breakage frequently experienced with other brittle alloys.

Less time is required for inspection and assembly since the terminal head is designed so that the thermocouple can be quickly inspected without disconnecting leads or using a screw driver. There is therefore no possibility of a wrong reconnection and no interruption of production. Thermocouple wires also enter connector without bending even when two-hole insulators are employed. This timesaving feature is of advantage to large companies who assemble their own thermocouples. The thermocouple element is easily replaced merely by loosening two screws. High grade ceramic connector body withstands high temperatures indefinitely, eliminating continual renewal of this part on severe applications.

ARKLAY S. RICHARDS CO., INC.,
74 Winchester St.,
Newton Highlands 61, Mass.
Mention R-252 for Reader Service